Exhibit 2

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG DISPLAY CO., LTD. AND DELL INC.,
Petitioner,

v.

SOLAS OLED, LTD.,
Patent Owner.

Case No. IPR2020-00140
Patent No. 6,072,450

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 6,072,450 UNDER 35 U.S.C. §§ 311–319 AND 37 C.F.R. § 42.100 *et seq.*

LIST OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 6,072,450 (the "'450 patent")
1002	File History for U.S. Patent No. 6,072,450
1003	U.S. Patent No. 5,670,792 ("Utsugi")
1004	JPH053079 (certified translation, "Manabe")
1005	WO 96/25020 (certified translation, "Eida")
1006	S.W. Amos, Principles of Transistor Circuits, 8th Ed. (1994)
1007	Declaration of Dr. Adam Fontecchio
1008	*Curriculum Vitae* of Dr. Adam Fontecchio
1009	JPH053079 ("Manabe")
1010	WO 96/25020 ("Eida")
1011	U.S. Patent No. 5,847,516 ("Kishita")

Table of Contents

I. Introduction.....1

II. Standing, Mandatory Notices, and Fee Authorization.....3

III. Summary of Challenge.....5

IV. Overview of the ’450 Patent.....6

A. Prosecution History.....12

V. Level of Ordinary Skill.....13

VI. Claim Construction.....13

A. “active elements”.....13

VII. Overview of the Prior Art.....14

A. Utsugi (Ex. 1003).....14

B. Manabe (Ex. 1004).....16

C. Eida (Ex. 1005).....17

VIII. Application of Prior Art to the Challenged Claims.....21

A. Ground I: Claims 1–2, 4–8, and 15–16 Are Anticipated by Utsugi.....22

1. Claim 1.....22

2. Dependent Claim 2.....31

3. Dependent Claim 4.....31

4. Dependent Claim 5.....34

5. Dependent Claim 6.....34

6. Dependent Claim 7.....36

7. Dependent Claims 8 and 16.....40

8. Claim 15 41

B. Ground II: Claims 1–2, 4–8, and 15–16 Are Obvious Over Utsugi. 53

1. Claim 1 54

2. Dependent Claims 2 and 4–7 56

3. Dependent Claims 8 and 16 56

4. Claim 15 58

C. Ground III: Claim 3 Is Obvious Over the Combination of Utsugi and Manabe. 62

1. Dependent Claim 3 62

D. Ground IV: Claims 9, 11–13, and 17–18 Are Obvious Over the Combination of Utsugi and Eida. 67

1. Motivation to Combine Eida with Utsugi 68

2. Dependent Claim 9 71

3. Dependent Claim 11 72

4. Dependent Claim 12 76

5. Dependent Claim 13 77

6. Dependent Claim 17 79

7. Dependent Claim 18 81

IX. Conclusion 82

I. INTRODUCTION

Samsung Display Co., Ltd. and Dell Inc. (together, "Petitioner") petition for *inter partes* review seeking cancellation of claims 1–9, 11–13, and 15–18 of U.S. Patent No. 6,072,450 (Ex. 1001, "'450 patent"), assigned to Solas OLED, Ltd. ("Patent Owner").

The '450 patent relates to an active matrix organic electroluminescent display (OLED) having a particular pixel area structure. In particular, the patent is directed to a display in which a first electrode (the cathode), an electroluminescent layer, and a second electrode (the anode) are all formed "so as to cover" the transistors for each pixel, with the first electrode shielding the transistors from visible light. Ex. 1001, 3:28–31; Ex. 1007, ¶ 45. This structure is shown in annotated Figure 2 below. Ex. 1001, 1:1:5–8, 2:66–3:7

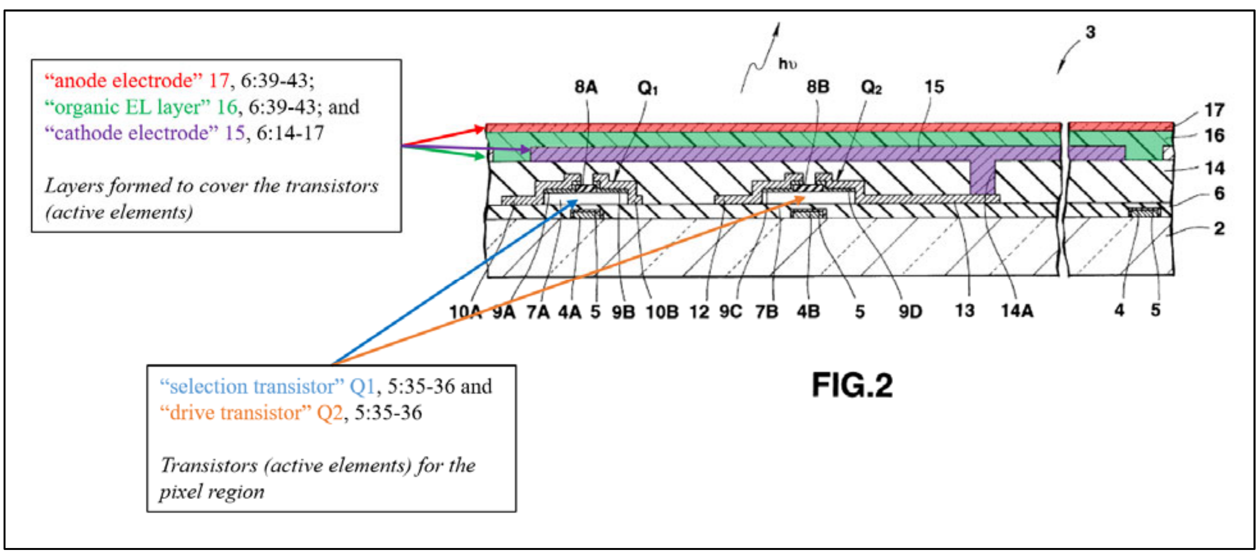
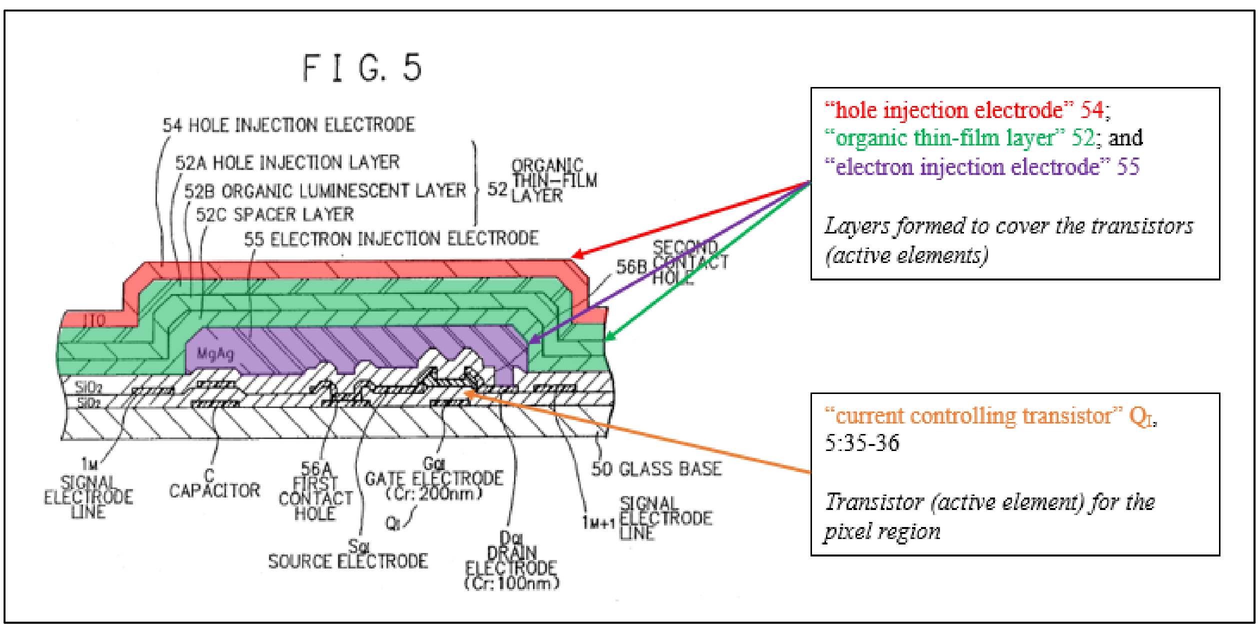


FIG.2

The purported benefits of such a structure are twofold: (1) to enlarge the overall light-emitting area of the pixel, allowing for high luminescence (brightness), and (2) to prevent light from the electroluminescent layer from entering the transistors. *See* Ex. 1001, 2:66–3:7; Ex. 1007, ¶¶ 46–47.

This display structure was not novel. Rather, it was specifically taught by the prior art Utsugi reference (Ex. 1003). As shown in annotated Figure 5 below, Utsugi likewise discloses an organic electroluminescent display (OLED), including transistors for each pixel, in which a first electrode ("electron injection electrode"), an electroluminescent layer ("organic thin-film layer"), and a second electrode ("hole injection electrode") each cover the transistors, with the first electrode shielding the transistor from visible light. Ex. 1007, ¶¶ 62–64.



Thus, Utsugi expressly discloses the structure that was the purported novel aspect of the claims of the ’450 patent, which the applicants relied on to distinguish the prior art of record during prosecution. In fact, Utsugi teaches all the limitations of claims 1–2, 4–8, and 15–16, and therefore anticipates these claims or, at a minimum, renders them obvious, as shown below in Grounds I and II.

Dependent claim 3, which requires the pixel electrode to have a rough surface in contact with the electroluminescent layer, is obvious over the combination of Utsugi and Manabe. Manabe discloses the structure required by claim 3—i.e., a first electrode with a rough surface in contact with the organic electroluminescent layer—and explains the benefits of implementing such a structure, as shown below in Ground III.

Dependent claims 9, 11–13, and 17–18 add further requirements concerning wavelength conversion and filter layers for multicolor or full-color displays that were well-known in the prior art and taught, for instance, by the Eida reference (Ex. 1005), as the Examiner recognized during prosecution. These claims are obvious over the combination of Utsugi and Eida, as shown below in Ground IV.

II. STANDING, MANDATORY NOTICES, AND FEE AUTHORIZATION

Grounds for Standing: Pursuant to 37 C.F.R. § 42.104(a), Petitioner certifies that the ’450 patent is available for IPR and that Petitioner is not barred or estopped

from requesting an IPR challenging the ’450 patent on the grounds identified in this petition.

Real Party-in-Interest: Petitioner identifies Samsung Display Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics America, Inc., Dell Inc., and Dell Technologies Inc. as real parties in interest.

Related Matters: Patent Owner has asserted the ’450 patent in litigation against the Samsung real parties-in-interest in *Solas OLED Ltd. v. Samsung Display Co., Ltd., et al.*, Case No. 2:19-cv-00152-JRG (E.D. Tex.). Patent Owner has further asserted the ’450 patent in litigation in *Solas OLED Ltd. v. Dell Technologies Inc.*, 6:19-cv-00514-ADA (W.D. Tex.); *Solas OLED Ltd. v. Google Inc.*, 6:19-cv-00515-ADA (W.D. Tex.); and *Solas OLED Ltd. v. Apple Inc.*, 6:19-cv-00537-ADA (W.D. Tex.).

Lead and Back-Up Counsel: Petitioner designates David A. Garr (Reg. No. 74,932, dgarr@cov.com) as lead counsel and Grant D. Johnson (Reg. No. 69,915, gjohnson@cov.com) as back-up counsel, both of Covington & Burling LLP, One CityCenter, 850 Tenth Street, NW, Washington, DC 20001 (postal and hand delivery), telephone: (202) 662-6000, facsimile: (202) 662-6291.

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Service Information: Service information is provided in the designation of counsel above. Petitioner consents to service of all documents via electronic mail at the email addresses above and at Samsung-Solas@cov.com.

Fee Authorization: The Office is authorized to charge $31,100 ($15,500 request fee and $15,600 post-institution fee) for the fees set forth in 37 C.F.R. § 42.15(a) (as well as any additional fees that might be due) to Deposit Account No. 60-3160.

III. SUMMARY OF CHALLENGE

Petitioner requests IPR of claims 1–9, 11–13, and 15–18 of the '450 patent based on the following grounds:

- ***Ground I:*** Claims 1–2, 4–8, and 15–16 are anticipated by Utsugi (Ex. 1003) under 35 U.S.C. § 102.
- ***Ground II:*** Claims 1–2, 4–8, and 15–16 are obvious based on Utsugi under 35 U.S.C. § 103.
- ***Ground III:*** Claim 3 is obvious based on the combination of Utsugi and Manabe (Ex. 1004) under 35 U.S.C. § 103.
- ***Ground IV:*** Claims 9, 11–13, and 17–18 are obvious based on the combination of Utsugi and Eida (Ex. 1005) under 35 U.S.C. § 103.

The ’450 patent was filed on November 21, 1997, and claims priority to two foreign applications filed on November 28, 1996. Under 35 U.S.C. § 154(a)(2), it expired on November 21, 2017. Each of the asserted references is available as prior art under 35 U.S.C. § 102 (pre-AIA),[1] as shown in the following table.

Exhibit	Reference	Date(s)	Availability as Prior Art
Ex. 1003	U.S. Patent No. 5,670,792 (“Utsugi”)	Oct. 12, 1994 (filed) Sep. 23, 1997 (issued)	§ 102(e)
Ex. 1004	JPH053079 (“Manabe”)	June 24, 1991 (filed) January 8, 1993 (published)	§§ 102(a) and 102(b)
Ex. 1005	WO 96/25020 (“Eida”)	February 5, 1996 (international application date) August 15, 1996 (published)	§§ 102(a) and 102(b)

IV. OVERVIEW OF THE ’450 PATENT

The ’450 patent (Ex. 1001) states that it “relates to a display apparatus, and more particularly to an electroluminescent (hereinafter referred to as EL) display apparatus with a matrix display panel including EL elements.” Ex. 1001, 1:5–8.

[1] Because the application for the ’450 patent was filed prior to March 16, 2013, the pre-AIA conditions for patentability apply.

Active matrix displays, like the one claimed in the ’450 patent, include a pair of transistors for each pixel, “which confer voltage storing capability on the pixels.” Ex. 1001, 1:47–51. These transistors are sensitive to light, such that if light from the EL elements enters the transistors it can generate “unnecessary photoelectromotive force” and cause the transistors to malfunction. *Id*., 2:27–32; Ex. 1007, ¶ 43. As shown in annotated Figure 22 below, in conventional designs, this problem was mitigated by not including light emitting layers above the transistors—i.e., by limiting the area of the EL layer 106 and anode 103 to prevent them from overlapping with the portion of the pixels dedicated to the transistors. Ex. 1001, 2:32–37. However, this reduces the total light emitting area of the pixel. *Id*.; Ex. 1007, ¶ 44.

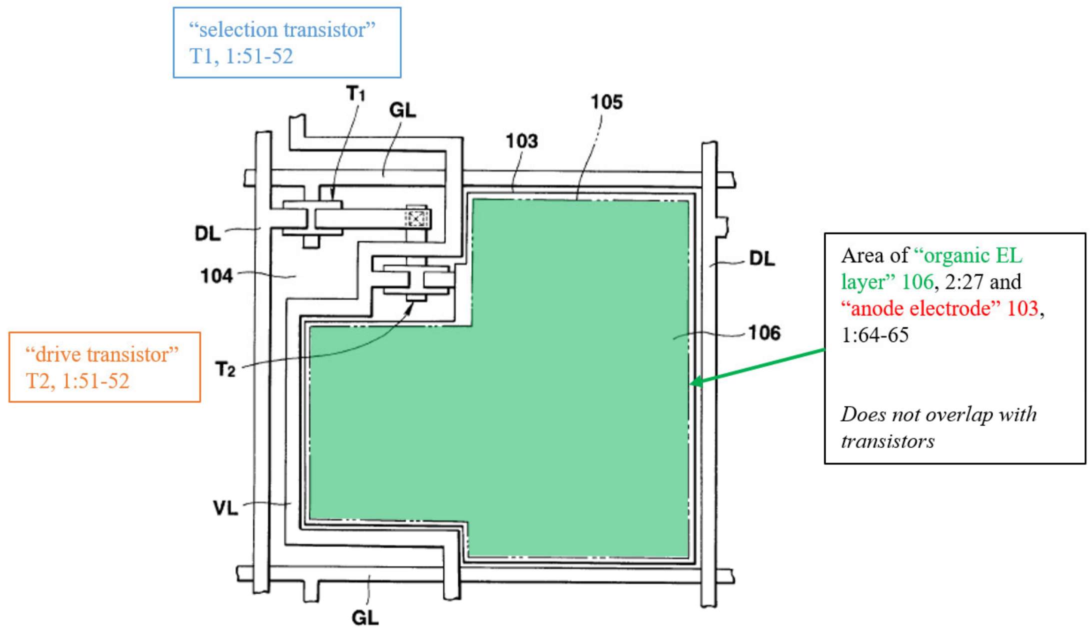


FIG.22

Display "according to the related art," 5:12-13

The '450 patent purports to increase the light emitting area to almost the entirety of the pixel region by having a first electrode (cathode), an EL layer, and a second electrode (anode) (together, these three elements are referred to in this petition as the "EL structure") that cover the selection and drive transistors. Ex. 1001, 7:66–8:61. As shown in annotated Figure 1 below, this structure allows for an increased aperture ratio—i.e., a majority of the pixel region emits light. *Id.*; Ex. 1007, ¶¶ 45–47.

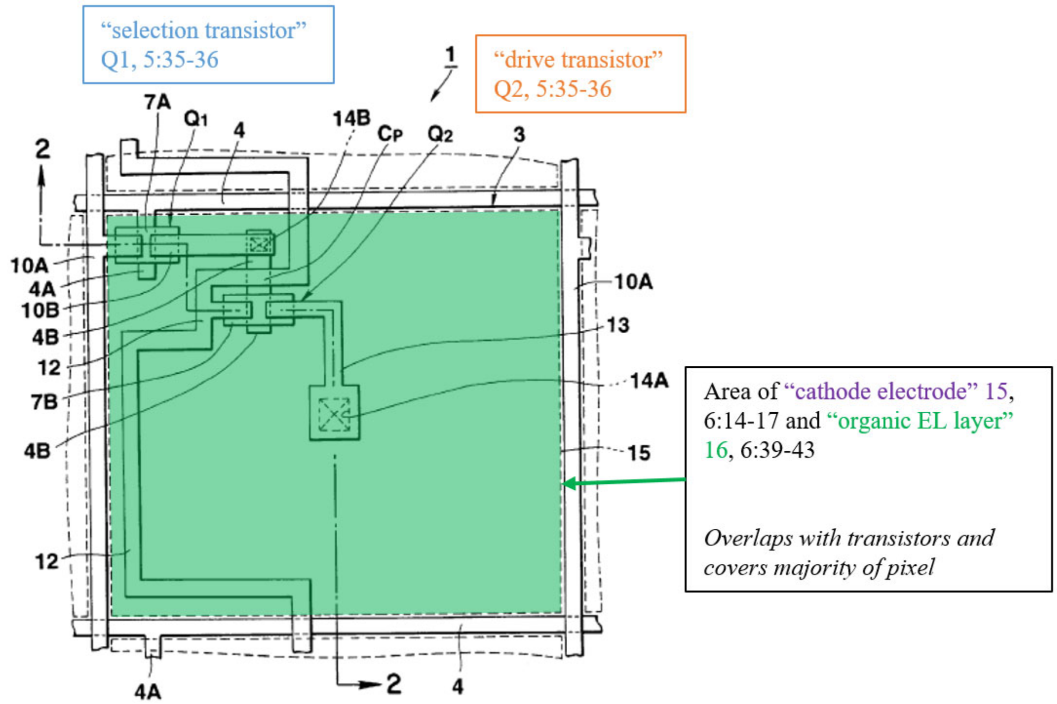
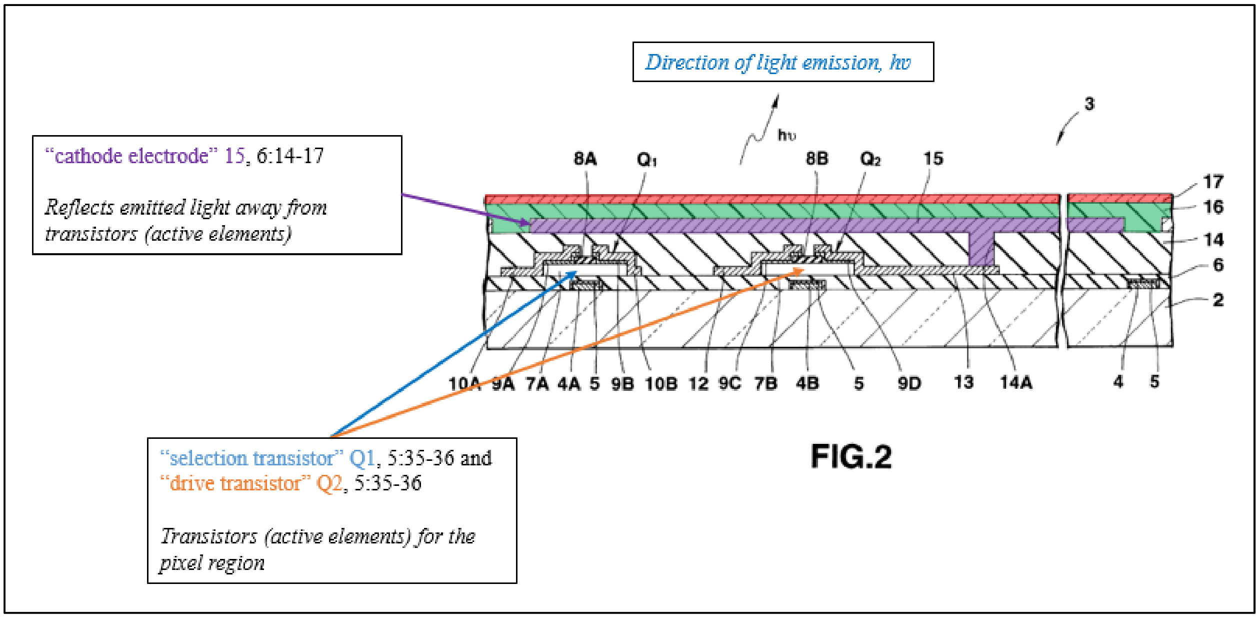


FIG.1

Display "according to one embodiment of the present invention," 4:28-29

The structure of the '450 patent avoids the problem of light entering the selection transistors Q1 and drive transistors Q2 by using a first electrode formed of a material, such as MgAg, which reflects light away from the transistors and out the top of the display, as indicated by the arrow labeled "hʋ" in the annotated cross section of Figure 2 below. Ex. 1007, ¶ 46.



The independent claims of the '450 patent are generally directed to a display apparatus having the above structure—i.e., a structure where the first electrode, electroluminescent layer, and second electrode each cover the associated transistors ("active elements"); and where the first electrode shields visible light. Independent claim 1 recites:

> A display apparatus comprising:
>
> [a]: a substrate;
>
> [b]: active elements formed over said substrate and driven by an externally supplied signal;
>
> [c]: an insulation film formed over said substrate so as to cover said active elements, said insulation having at least one contact hole;
>
> [d]: at least one ***first electrode*** formed on said insulation film so as to ***cover said active elements***, and connected to said active elements

through said at least one contact hole, said at least one first electrode being made of a material which ***shields visible light***;

[e]: an ***organic electroluminescent layer*** having an organic electroluminescent material formed on said at least one first electrode so as to ***cover said active elements*** and including at least one layer which emits light in accordance with a voltage applied to said at least one layer;

[f]: at least one ***second electrode*** formed on said organic electroluminescent layer which ***covers said active elements***.

The '450 patent also includes embodiments and claims directed to the use of wavelength conversion layers and/or color filters for multicolor or full-color displays, as shown in annotated Figure 12 below.

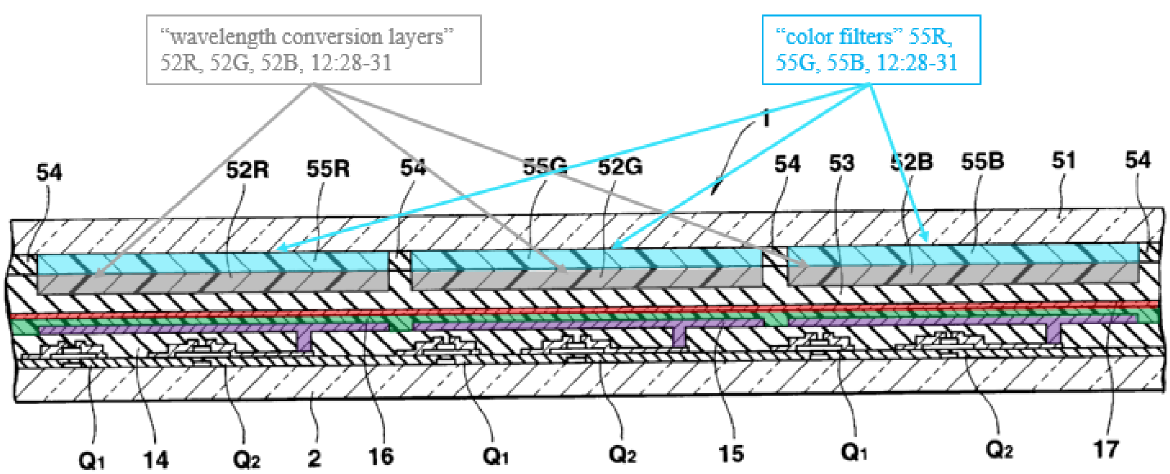


FIG.12

These layers and filters, which are formed on top of the EL structures, can be used to optimize the color of the light output. The wavelength conversion layers absorb

light emitted from the electroluminescent layers and emit light of a different wavelength (e.g., absorb blue light from the electroluminescent layers and emit red light). Ex. 1001, 11:47–65; Ex. 1007, ¶ 48. The color filters, in turn, are used to filter the emitted light—i.e., permitting only a narrower wavelength to pass through, resulting in a higher color purity. Ex. 1001, 12:49–13:17; Ex. 1007, ¶ 48.

A. Prosecution History

Original independent claims 1 and 16 of the application that resulted in the '450 patent were rejected as (i) anticipated by U.S. Patent No. 5,684,365 ("Tang") and (ii) obvious based on the combination of Tang and U.S. Patent No. 5,847,516 ("Kishita"), respectively. Ex. 1002, 154–162 (August 31, 1999 Non-Final Rejection). In response, the applicant amended the independent claims to specify that the EL layers were "organic" EL layers, and that, in addition to the insulation film and first electrode being formed so as to cover the active elements of the pixel, the organic EL element and second electrode were also formed so as to cover the active elements. *Id*., 294–307 (November 30, 1999 Amendment).

To overcome the Examiner's rejections, the applicant stressed that "[s]ince the organic electroluminescent layer is flexibly arrangeable regardless of the positional relationship with the active elements, the present claimed invention can enlarge a luminescent area of the electroluminescent layer," and "[i]n the present claimed invention . . . the at least one first electrode prevents the visible light emitted

by the electroluminescent layer from entering the active elements because the at least one first electrode includes a material that shields the visible light." *Id.*, 300.

The Examiner subsequently issued a Notice of Allowance. *See id.*, 312–317 (January 14, 2000 Notice of Allowance).

V. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art ("POSA") of the '450 patent at the time of the alleged invention would have had a relevant technical degree in Electrical Engineering, Computer Engineering, Materials Science, Physics, or the like, and experience in active matrix display design and electroluminescence. Ex. 1007, ¶ 54.

VI. CLAIM CONSTRUCTION

In IPR proceedings, claims are now construed "in accordance with their ordinary and customary meaning" in light of the specification. 37 C.F.R. § 42.100(b); *see Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005). For purposes of this petition, Petitioner does not believe that any specialized constructions are necessary. However, for purposes of clarity, the term "active elements" is addressed briefly below.

A. "active elements"

A number of claims include the term "active elements." In electronics, "active elements" generally are understood to be elements that supply energy to a circuit, for instance, by controlling the flow of current. Ex. 1007, ¶ 57. While the '450 patent specification does not expressly define the term, it is clear that the '450 patent

considers transistors to be "active elements." Ex. 1001, 3:4–7 ("It is another object of the present invention to provide a display apparatus which prevents light from entering *active elements such as transistors*." (emphasis added)); *see also id*., cls. 4 ("said active elements are a selection transistor . . . and a drive transistor"), 7 ("said active elements are transistors"); Ex. 1007, ¶¶ 57–58. Accordingly, "active elements" should be interpreted to encompass transistors (at a minimum).

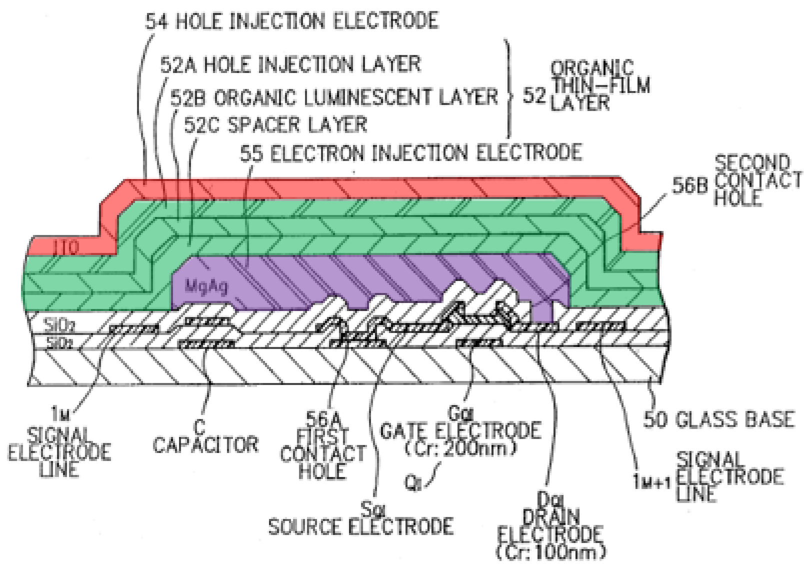
VII. OVERVIEW OF THE PRIOR ART

A. Utsugi (Ex. 1003)

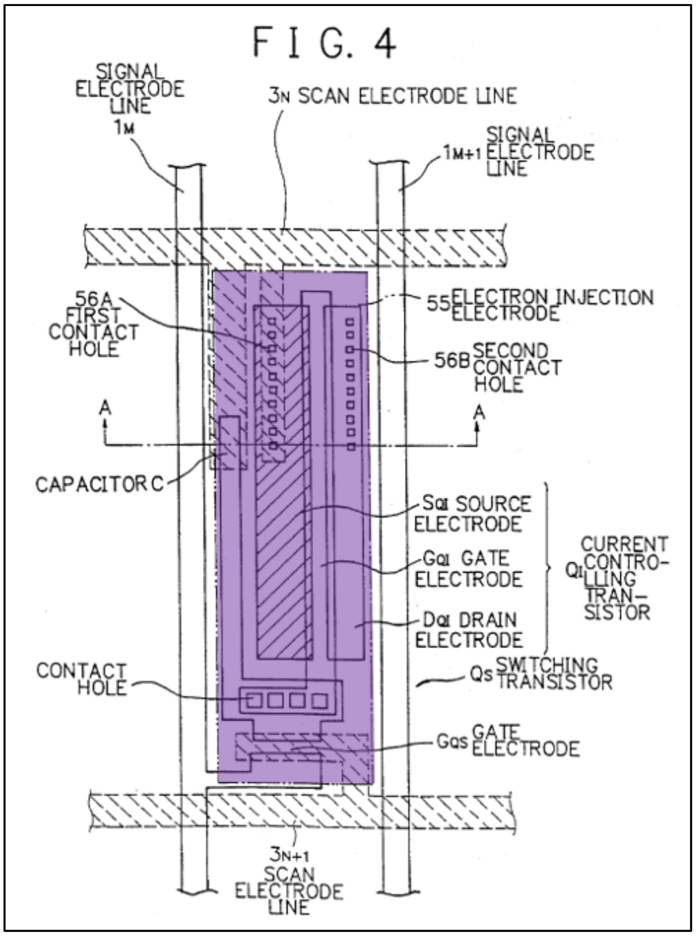
U.S. Patent No. 5,670,792 ("Utsugi") was filed on October 12, 1994 and is prior art under 35 U.S.C. § 102(e). Utsugi was not cited or considered during prosecution.

Like the '450 patent, Utsugi is directed to an organic, active matrix electroluminescent display (OLED). As shown in annotated Figure 5 below, Utsugi discloses an organic EL structure consisting of an electron injection electrode 55, an organic thin-film layer 52 (i.e., EL layer), and a hole injection electrode 54. Ex. 1007, ¶¶ 62–64.

FIG. 5



Utsugi discloses that the organic EL structure covers almost the entirety of the pixel. Ex. 1003, 6:53–59 ("[T]he electron injection electrode 55 is patterned like an independent i[s]land in each picture element region, while the organic thin-film layer 52 and the hole injection electrode 54 are made common to the whole picture elements of the luminous element array, i.e., formed over the entire region of a display panel."). This includes covering the switching transistor Q_s and the current controlling transistor Q_I (i.e., the active elements), as shown in Figure 4 below. *See also, id.*, 6:23–29 ("The luminescent element EL as a layered organic thin-film EL element extends over the capacitor C and the transistors Q_I and Q_S, covering substantially the entirety of the picture element region."); Ex. 1007, ¶¶ 64–65.



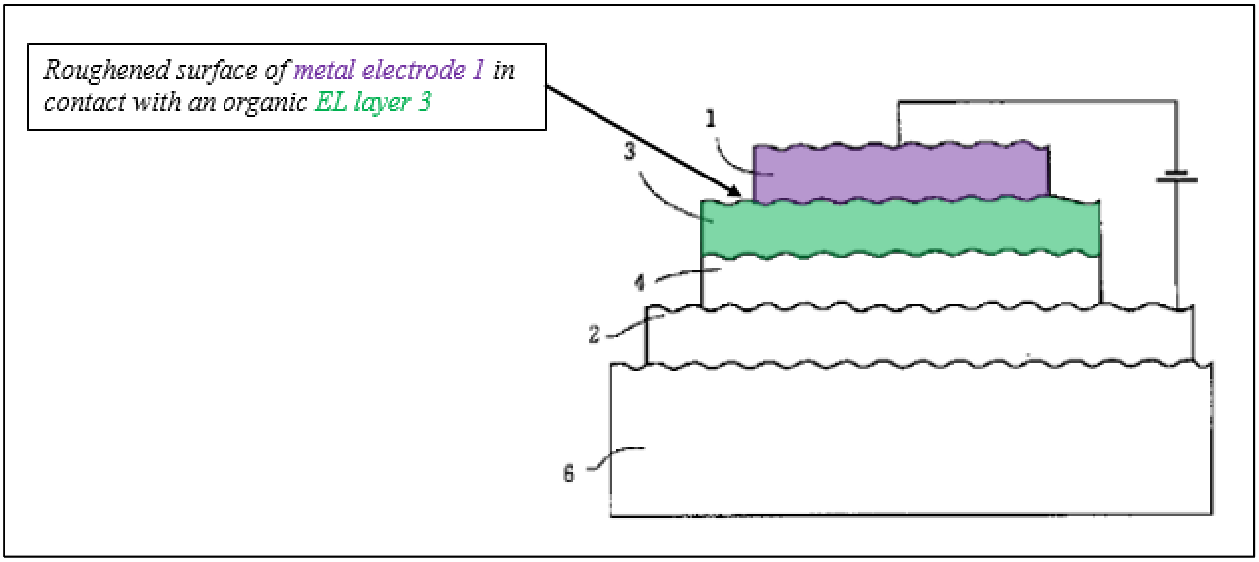
B. Manabe (Ex. 1004)

JPH053079 (Ex. 1004, certified translation, "Manabe") is a Japanese patent application publication, published on January 8, 1993, which is prior art under 35 U.S.C. §§ 102(a) and 102(b).[2] Manabe was not cited or considered during prosecution.

Like the '450 patent and Utsugi, Manabe is directed to an "[o]rganic EL element." Ex. 1004, Title. In particular, it teaches the use of a roughened metal

[2] The original Japanese version of Manabe is included as Ex. 1009.

electrode in contact with an organic electroluminescent layer to improve display quality, as shown in annotated Figure 1 below. *See, e.g.,* Ex. 1004, ¶ 24 ("Therefore, roughening of the surface of . . . of the metal electrode in contact with the organic EL layer causes slight differences in the light path from light sources within the light emission layer causing averaging of the interference effect and reducing angle dependence and film thickness dependence."); Ex. 1007, ¶ 67.



The roughened metal electrode helps to prevent disuniformity of luminance based on viewing angle. Ex. 1004, ¶ 31 ("Therefore, interference effect is averaged, and changes in visual angle dependence in luminance and the light emitting spectrum and variation in membrane thickness are suppressed."); Ex. 1007, ¶ 66.

C. Eida (Ex. 1005)

WO 96/25020 (Ex. 1005, certified translation, "Eida") is a PCT publication, published on August 15, 1996, which is prior art under 35 U.S.C. §§ 102(a) and

102(b).[3] It is substantively identical to U.S. Patent No. 5,909,081, a U.S. counterpart that was cited during prosecution of the '450 patent and applied by the Examiner.[4]

As with the '450 patent and Utsugi, Eida is directed to organic electroluminescent display (OLED) technologies. Ex. 1005, 1:5–8; *cf.* Ex. 1001, 1:6–12, 4:28–33. In particular, it teaches the use of color conversion and color filter layers to create a multi-color or full-color display. Ex. 1005, 1:5–8; Ex. 1007, ¶ 71.

Eida includes two embodiments directed to structures for multi-color light emission apparatus, a "first invention" and "second invention." As shown in annotated Figure 5 below, the first invention of Eida is a top-emitting apparatus, including two "fluorescent layers" and three "color filters." These are formed above the EL structure, comprising the transparent electrode 1a, the organic compound layer 1b, and the electrode 1c. Ex. 1007, ¶ 69.

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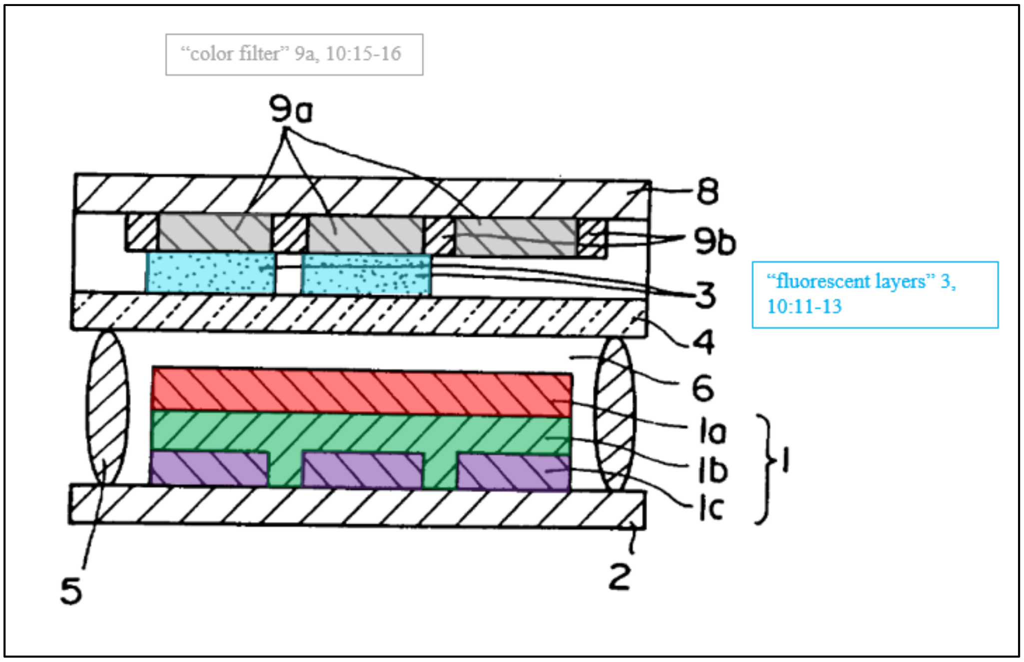
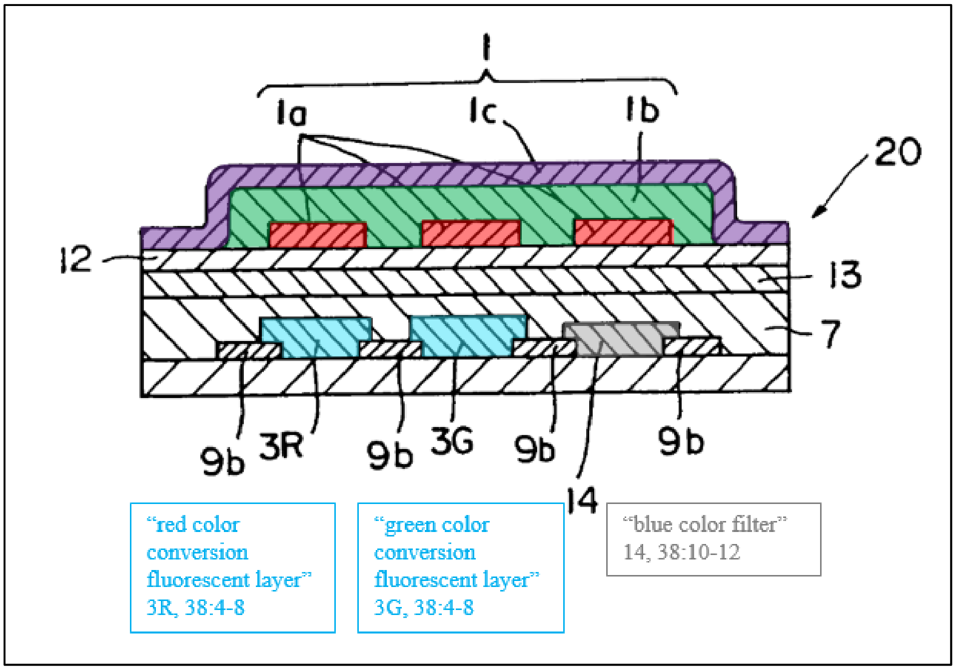
[3] The original Japanese version of Eida is included as Ex. 1010.

[4] Although used as a ground for rejection, U.S. Patent No. 5,909,081 indicates that its 102(e) date is August 6, 1997, whereas the '450 patent claims priority to earlier foreign applications.



As shown in annotated Figure 13 below, the second invention of Eida is a bottom-emitting apparatus, which again includes two fluorescent (color conversion) layers—a red color conversion layer 3R and a green color conversion layer 3G, as well as color filters to increase color purity. While only a single blue color filter is shown in Figure 13 (i.e., blue color filter 14), Eida notes that red and green color filters can be included as well. Ex. 1005, 38:4–8; Ex. 1007, ¶ 72.



Eida further explains that filters may be used to promote color purity, *see, e.g.*, Ex. 1005, 10:15–16 ("Further, as shown in FIG. 5, a color filter 9a may be arranged on each of the fluorescent layers 3 to control the fluorescent colors and thereby to promote the color purity."), and that color conversion layers may be used in conjunction with such color filters to increase color efficiency, *see id.*, 3:8–15; Ex. 1007, ¶ 195.

In view of these disclosures (which appear identically in U.S. Patent No. 5,909,081), the Examiner correctly determined during prosecution of the '450 patent that the disclosures of Eida teach (i) that "a fluorescent layer may *convert the light emitted from an organic EL device into light of a wave length longer* than that of the light emitted from the organic EL device" and (ii) that "a *color filter* may be arranged on each of the fluorescent layers to control the fluorescent colors and thereby to

promote the color purity." Ex. 1002, 159 (August 31, 1999 Non-Final Rejection) (emphases added).

VIII. APPLICATION OF PRIOR ART TO THE CHALLENGED CLAIMS

Anticipation requires the disclosure in a single prior art reference of each and every element of the claimed invention, arranged as in the claim. *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1458 (Fed. Cir. 1984). Ground I details how Utsugi discloses each and every claim element of claims 1–2, 4–8, and 15–16, as arranged in those claims.

The framework for determining obviousness is set forth in the well-known factors outlined in *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1996). The Petition analyzes the *Graham* factors below. Ground II details how claims 1–2, 4–8, and 15–16 were obvious based on Utsugi and the knowledge of a POSA. Ground III details how claim 3 of the '450 patent was obvious based on the combination of Utsugi and Manabe. Ground IV details how claims 9, 11–13, and 17–18 were obvious based on the combination of Utsugi and Eida.

None of the prior art references or arguments in Grounds I–III were considered by the Examiner. Nor was the combination provided in Ground IV, including the Utsugi reference that was not before the Examiner. The Fontecchio Declaration (Ex. 1007) was also not before the Examiner. Accordingly, none of the

arguments raised in this Petition were previously presented to the USPTO. 35 U.S.C. § 325(d).

A. Ground I: Claims 1–2, 4–8, and 15–16 Are Anticipated by Utsugi.

As shown below, Utsugi discloses a display with a structure satisfying all of the elements of claims 1–2, 4–8, and 15–16. Therefore, Utsugi anticipates these claims.

1. Claim 1

1[preamble]: A display apparatus comprising:

To the extent the preamble is limiting, it is disclosed by Utsugi. Utsugi discloses a display apparatus, stating, for example, that "[t]he present invention relates . . . in particular to a current-controlled luminous element array of an active matrix type such as for a display purpose." Ex. 1003, 1:6–9; Ex. 1007, ¶ 73.

1[a]: a substrate;

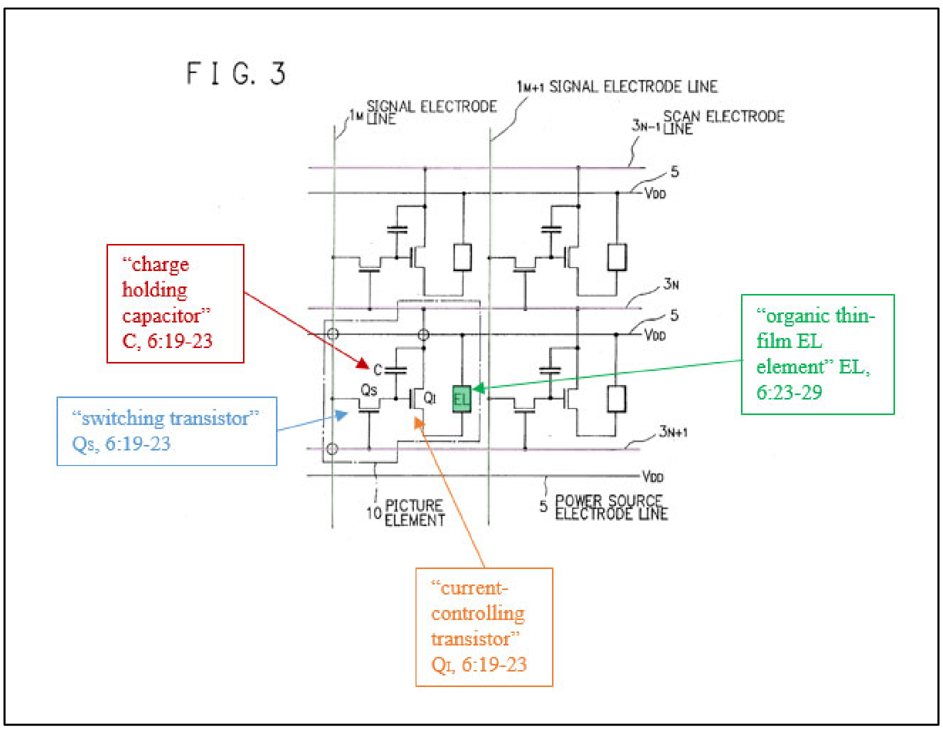
Utsugi discloses a substrate, i.e., "glass base 50," upon which the remainder of the EL element is built. Ex. 1003, 6:37–40; Ex. 1007, ¶ 75.

1[b]: active elements formed over said substrate and driven by an externally supplied signal;

Utsugi discloses active elements formed over said substrate (glass base 50) and driven by an externally supplied signal. Utsugi discloses two active elements, i.e., "current-controlling transistor Q_I" and "switching transistor Q_S." Ex. 1003, 6:19–23. Utsugi discloses that current-controlling transistor Q_I and switching

transistor Q_S are formed over, i.e., on top of, glass base 50. Ex. 1003, 7:20–45; *see also id.*, Figure 5 (illustrating the gate, drain, and source electrodes, G_{QI}, D_{QI}, and S_{QI}, formed over glass base 50); Ex. 1007, ¶¶ 77–78.

As shown in Figure 3 below, the gate of switching transistor Q_S is connected to the scan electrode line. *See also*, Ex. 1003, 7:9–12. When "the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on," and image data from the signal electrode line 1_M is "imposed via the switching transistor Q_S on the charge holding capacitor C" and the gate of current-controlling transistor Q_I. *Id.*, 8:11–16; Ex. 1007, ¶ 79. Accordingly, the switching transistor is driven by the external signal from the scan electrode line, while the drive transistor is driven by the external signal from the signal electrode line. Ex. 1007, ¶ 79.



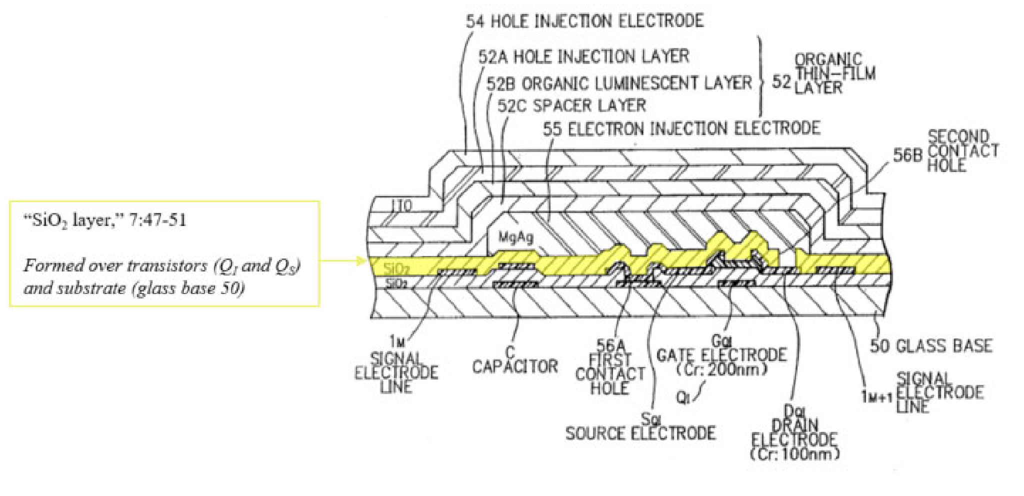
1[c]: an insulation film formed over said substrate so as to cover said active elements, said insulation having at least one contact hole;

Utsugi discloses an insulation film, i.e., a SiO_2 layer, formed over said substrate (glass base 50) so as to cover said active elements (transistors Q_S and Q_I), said insulation film having at least one contact hole.

First, Utsugi discloses that after the switching transistor Q_S and current-controlling transistor Q_I are formed on the substrate, Ex. 1003, 7:20–45, "a SiO_2 layer is let grow 200 nm, before an etching to open the second contact holes 56B for intercommunication between the source electrode S_{QI} of the current-controlling transistor Q_I and the electron injection electrode 55 to be formed as a lower electrode of the organic thin-film EL element." Ex. 1003, 7:46–51; Ex. 1007, ¶ 82. As a POSA would appreciate, SiO_2 is a commonly used insulating material. Ex. 1007, ¶ 82.

Second, Utsugi discloses that, as shown in annotated Figure 5 below, the SiO_2 layer covers the active element Q_I, and that a contact hole 56B is formed in the SiO_2, so as to allow contact between the electron injection electrode 55 and the drain electrode D_{QI} of the current-controlling transistor Q_I. Ex. 1003, 7:46–51; Ex. 1007, ¶ 83.

FIG. 5

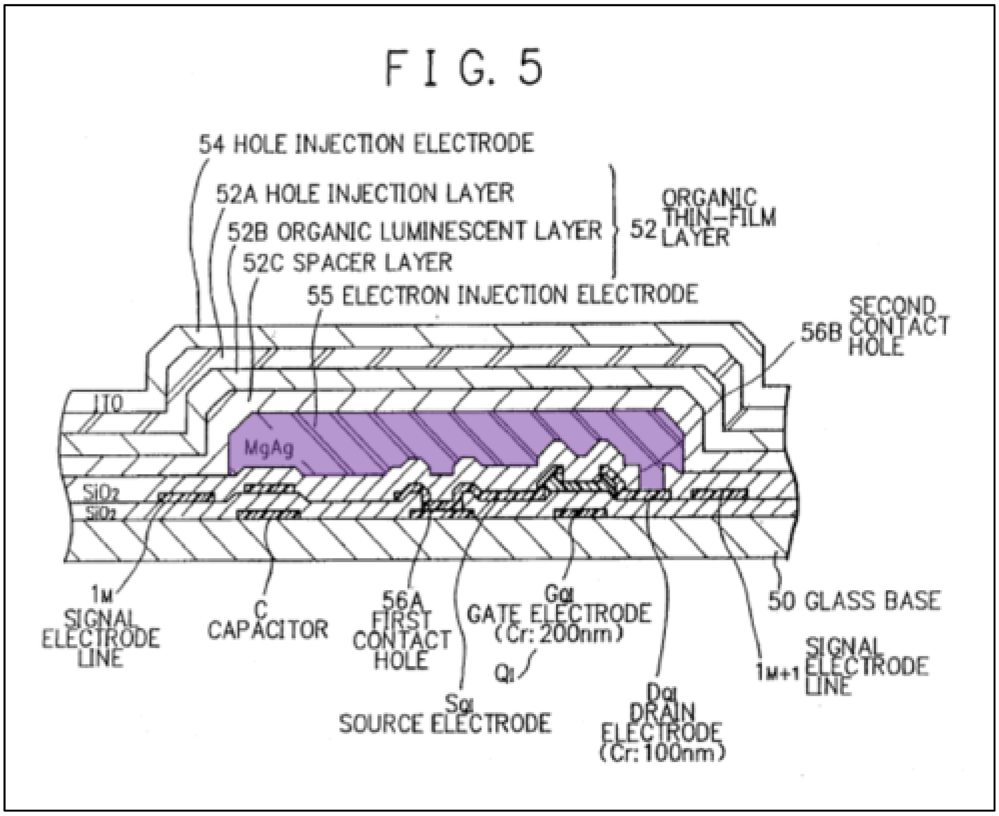


Third, Utsugi describes the SiO_2 layer as being deposited over the "luminous element array," Ex. 1003, 7:16–19, after switching transistor Q_S has been formed—and accordingly teaches that the SiO_2 layer covers the active element Q_S. Figure 5 shows the SiO_2 layer as being continuous, apart from having the second contact hole 56B (which is the only portion of the SiO_2 layer that is disclosed as being patterned). Ex. 1003, 7:47–52; Ex. 1007, ¶ 84. Further, the pixel electrode is described as covering the majority of the pixel, including both transistors, *see* Ex. 1003, Figure 4, meaning that the SiO_2 layer must cover the switching transistor Q_S, in addition to current-controlling transistor Q_I, so as to prevent shorting of the source and drain electrodes of the transistors and the electron injection electrode 55. Ex. 1007, ¶ 84.

1[d]: at least one first electrode formed on said insulation film so as to cover said active elements, and connected to said active elements through said at least one contact hole,

said at least one first electrode being made of a material which shields visible light;

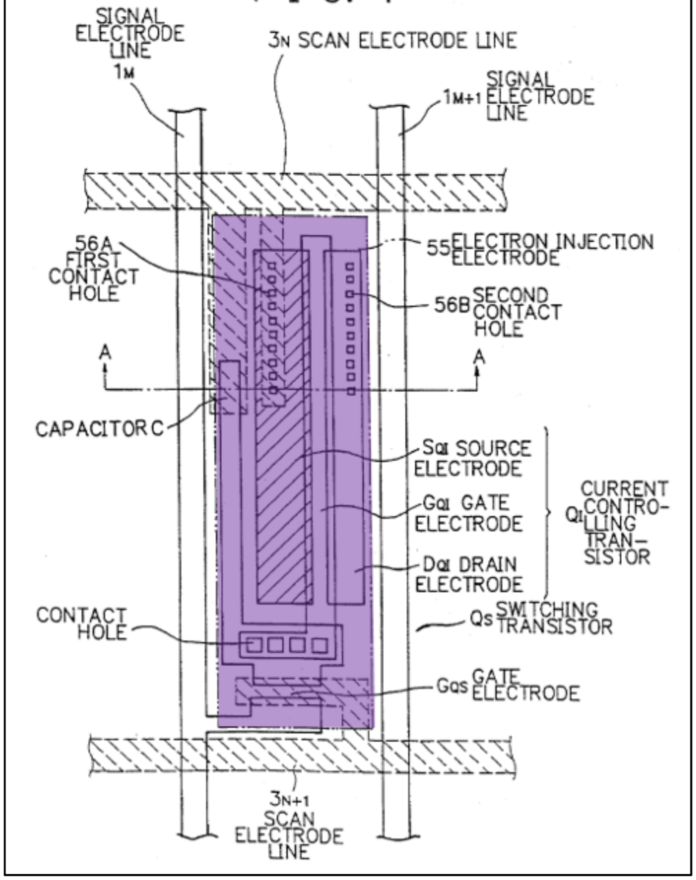
Utsugi discloses this limitation. First, Utsugi discloses a first electrode, i.e., electron injection electrode 55, formed on said insulation film (SiO_2 layer), as shown in annotated Figure 5, below. *See also* Ex. 1003, 7:47–57 ("[A] SiO_2 layer is let grown 200 nm . . . [t]hen, an MgAg layer is let to grow 200 nm . . . ."); Ex. 1007, ¶ 86.



As shown in annotated Figure 4 below, the electron injection electrode 55 (purple) is formed so as to cover almost the entirety of the pixel, including both transistors. *See also* Ex. 1003, 6:23–29 ("The luminescent element EL as a layered organic thin-film EL element extends over the capacitor C and the transistors Q_I and

Q_S, covering substantially the entirety of the picture element region.”); Ex. 1007, ¶ 87.

FIG. 4



Second, Utsugi discloses that the first electrode is connected to said active elements (transistors Q_S and Q_I) through a contact hole, as shown in Figure 5 and as described in the manufacturing steps: “etching to open the second contact holes 56B for intercommunication between the source electrode S_{QI} of the current-controlling transistor Q_I and the electron injection electrode 55.” Ex. 1003, 7:46–51; Ex. 1007, ¶ 88.

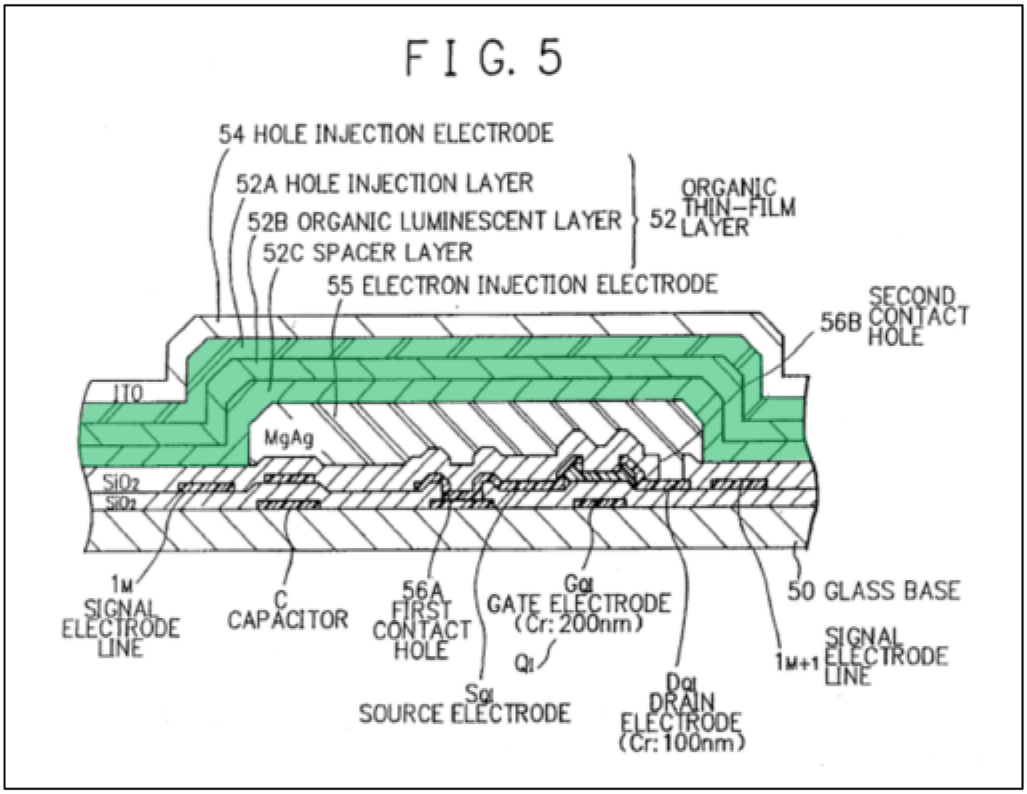
Third, Utsugi discloses that this first electrode (electron injection electrode) is made of a “metallic material MgAg.” Ex. 1003, 6:47–50. A metallic electrode made of MgAg would be reflective and shield visible light. Ex. 1007, ¶ 89. Indeed, the ’450 patent identifies magnesium-based metals, such as MgAg and MgIn as suitable materials for forming the first electrode (cathode), which is described as shielding visible light. Ex. 1001, 8:49–54, 17:25–27.

1[e]: an organic electroluminescent layer having an organic electroluminescent material formed on said at least one first electrode so as to cover said active elements and including at least one layer which emits light in accordance with a voltage applied to said at least one layer;

Utsugi discloses this limitation. First, as shown in annotated Figure 5 below, Utsugi discloses an organic electroluminescent layer, i.e., organic thin-film layer 52, formed on said first electrode (electron injection electrode 55). Ex. 1007, ¶ 91.

Second, Utsugi teaches that this organic thin-film layer 52 includes at least one layer which emits light in accordance with a voltage applied to said layer—i.e., organic luminescent layer 52B. *See* Ex. 1003, 6:59–63 (“[W]hen an arbitrary picture element is selected to be driven, there develops an electric field acting thereon, causing the organic luminescent layer 52B to luminesce, externally emitting flux of light through the transparent electrode 54.”); *see also id.*, 8:20–28 (“[A]n electric current runs through an established conducting route: the power source electrode

line 5→the luminescent element EL→the transistor Q_I→the scan electrode line causing the luminescent element EL to luminesce.”); Ex. 1007, ¶ 92.

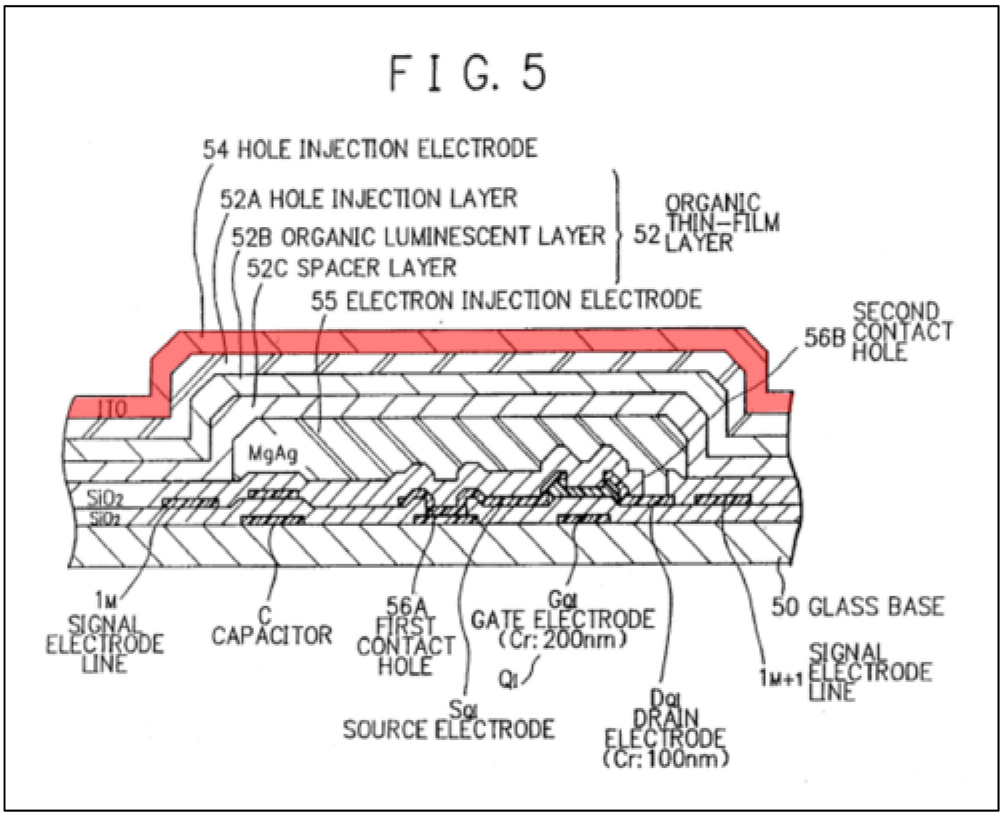


Third, Utsugi discloses that the organic thin-film layer 52, as well as the remainder of the EL structure, is formed so as to cover the entire picture element region, including the active elements (transistors Q_S and Q_I): “The luminescent element EL as a layered organic thin-film EL element extends over the capacitor C and the transistors Q_I and Q_S, covering substantially the entirety of the picture element region.” Ex. 1003, 6:23–29; *see also id.*, Ex. 1003, 6:53–59 (“[T]he organic thin-film layer 52 and the hole injection electrode 54 are made common to the whole

picture elements of the luminous element array, i.e., formed over the entire region of a display panel."); Ex. 1007, ¶ 93.

1[f]: at least one second electrode formed on said organic electroluminescent layer which covers said active elements

Utsugi discloses this limitation. First, as shown in annotated Figure 5 below, Utsugi discloses a second electrode, i.e., hole injection electrode 54, formed on said organic electroluminescent layer (organic thin-film layer 52). Ex. 1007, ¶ 95.



Second, as described above for element 1[e], Utsugi discloses that the hole injection electrode, as well as the remainder of the EL structure, is formed so as to cover the entire picture element region, including the active elements (transistors Q_S and Q_I): "The luminescent element EL as a layered organic thin-film EL element

extends over the capacitor C and the transistors Q_I and Q_S, covering substantially the entirety of the picture element region." Ex. 1003, 6:23–29; *see also id*., Ex. 1003, 6:53–59 ("[T]he organic thin-film layer 52 and the hole injection electrode 54 are made common to the whole picture elements of the luminous element array, i.e., formed over the entire region of a display panel."). Ex. 1007, ¶ 96.

2. Dependent Claim 2

The display apparatus according to claim 1, wherein said at least one first electrode is formed of a conductive material containing magnesium.

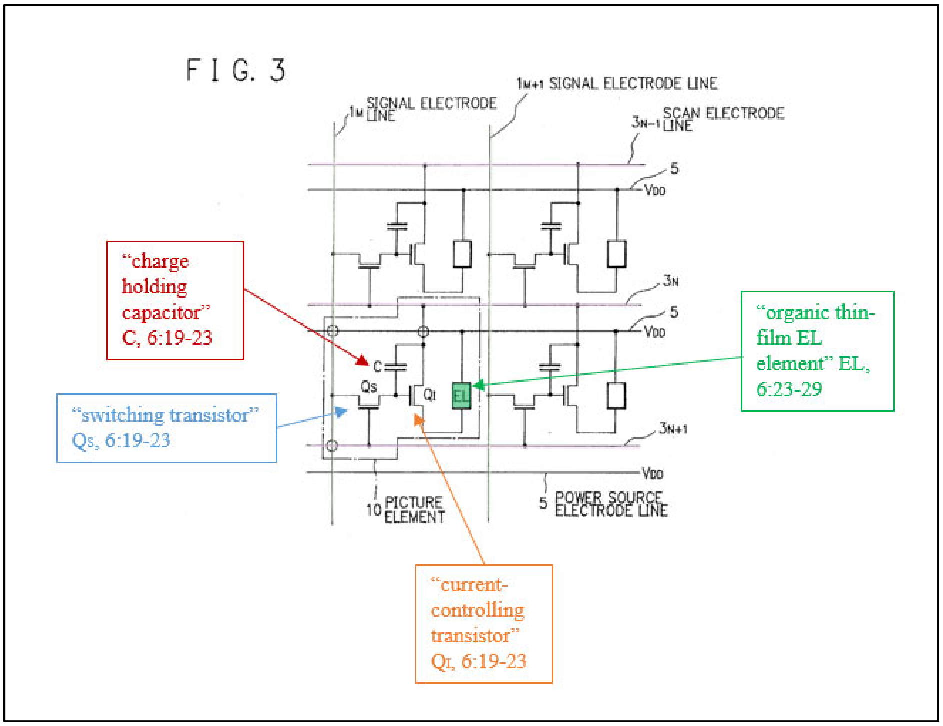
Utsugi discloses that the first electrode (i.e., electron injection electrode 55), is formed of a material containing magnesium, i.e., "metallic material MgAg." Ex. 1003, 6:47–50. Utsugi further discloses that the electron injection electrode 55 can also be formed, in the alternative, of Mg or Mg:In. *See id.*, 9:11–13. A POSA would understand the first electrode to be conductive, as it is made of metal, and given that its purpose is to provide charge to the organic electroluminescent layer. Ex. 1007, ¶ 99.

3. Dependent Claim 4

4[a] The display apparatus according to claim 1, wherein said active elements are a selection transistor which is turned on in response to an externally supplied address signal and

Utsugi's "switching transistor Q_S" satisfies this element. As described for element 1[b] above, and as shown in annotated Figure 3 below, the gate of Q_S is

connected to the scan electrode line (i.e., the address line). *See also*, Ex. 1003, 7:9–12.



When "the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on," *Id.*, 8:11–16. A POSA would understand that the scan electrode line is an address line, as it addresses a row of pixels. Ex. 1007, ¶ 101. Thus, the switching transistor Q_S is turned on in response to the externally supplied address signal.

> **4[b] a drive transistor, which is driven by a signal corresponding to image data supplied externally through said selection transistor while said selection transistor is on, for controlling a voltage to be applied to said organic electroluminescent layer,**

Utsugi's "current-controlling transistor Q_I" satisfies this element. As discussed above for limitation 4[a], when "the scan electrode line 3_{N+1} is selected,

the switching transistor Q_S is turned on," and image data from electrode line 1_M is "imposed via the switching transistor Q_S on the charge holding capacitor C" and the gate of current-controlling transistor Q_I. Ex. 1003, 8:11–16. Accordingly, image data is supplied externally from the electrode line through the switching transistor. Ex. 1007, ¶ 104.

Utsugi discloses that this transistor controls the current, and therefore the voltage across the organic electroluminescent layer. *See* 1003, 6:59–63 ("[W]hen an arbitrary picture element is selected to be driven, there develops an electric field acting thereon, causing the organic luminescent layer 52B to luminesce, externally emitting flux of light through the transparent electrode 54."); *see also id.*, 8:20–28 ("[A]n electric current runs through an established conducting route: the power source electrode line 5→the luminescent element EL→the transistor Q_I→the scan electrode line causing the luminescent element EL to luminesce."); Ex. 1007, ¶ 105.

4[c] said selection transistor and said drive transistor forming a pair.

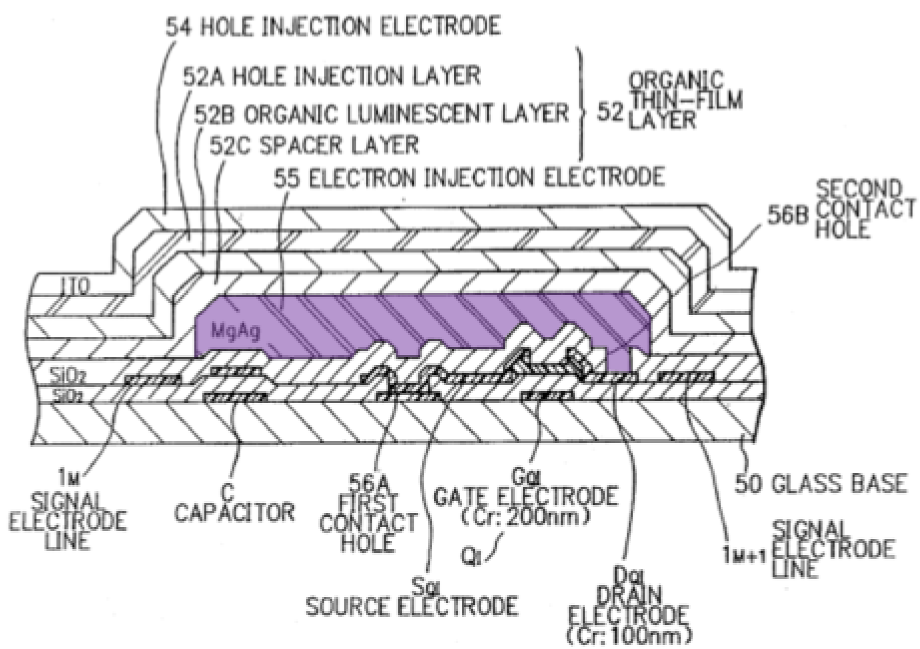
Utsugi's active elements (transistors Q_S and Q_I) satisfy this limitation. Utsugi discloses that these transistors comprise "*a pair of* reversely staggered a-SiTFT (amorphous silicon thin-film transistor)'s as a switching transistor and a current-controlling transistor . . . ." Ex. 1003, 5:50–56 (emphasis added); Ex. 1007, ¶ 106.

4. Dependent Claim 5

The display apparatus according to claim 4, wherein said at least one first electrode is connected to said drive transistor through said at least one contact hole.

As shown in annotated Figure 5 below, Utsugi discloses that "electrode 55 [the first electrode] is connected through second contacts in second *contact holes* 56B to a drain electrode $[D]_{QI}$ of the current-controlling transistor Q_I [the drive transistor]." Ex. 1003, 6:50–52 (emphasis added); Ex. 1007, ¶ 108.

FIG. 5

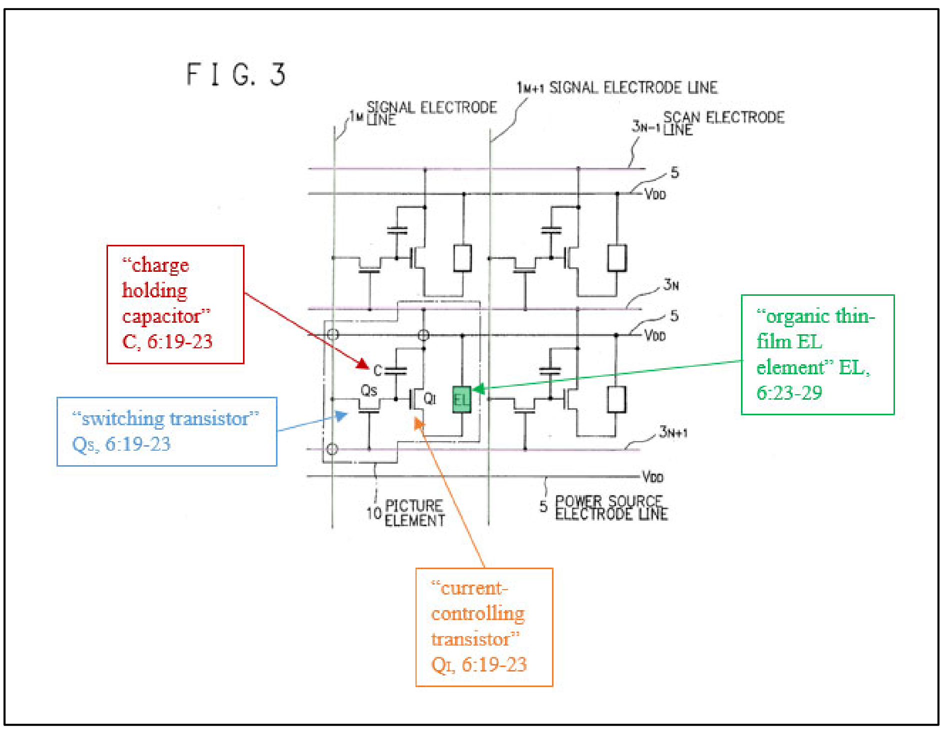


5. Dependent Claim 6

6[a]: The display apparatus according to claim 4, wherein: said display apparatus further comprises a capacitor for retaining the signal corresponding to the image data

externally supplied through said selection transistor while said selection transistor is on; and

Utsugi discloses a capacitor for retaining the signal corresponding to the image data externally supplied through said selection transistor while said selection transistor is on. As shown in annotated Figure 3 below, when "the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on," and image data from electrode line 1_M is "imposed via the switching transistor Q_S on the *charge holding capacitor C*." Ex. 1003, 8:11–16 (emphasis added). As explained for element 6[b] below, the capacitor retains the voltage from the signal corresponding to the image data, such that it can be held when the switching transistor is turned off. Ex. 1007, ¶ 110.



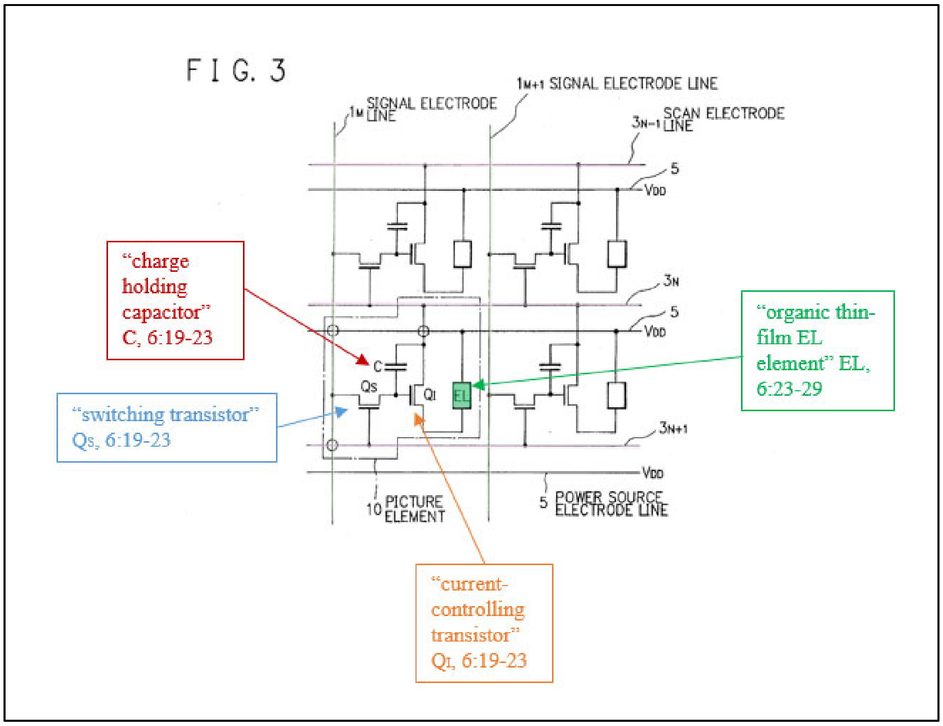
6[b]: while said selection transistor is off, said drive transistor is driven by the signal retained in said capacitor.

Utsugi discloses that while said selection transistor is off, said drive transistor is driven by the signal retained in said capacitor: "Thereafter, the scan electrode line 3_{N+1} enters a non-selected state. The switching transistor Q_S then turns off, and the charge holding capacitor C holds thereacross the imposed voltage from the signal electrode line 1_M." Ex. 1003, 8:16–31. Accordingly, the voltage from the capacitor is used to drive the current-controlling transistor Q_I, while the selection transistor is off. Ex. 1007, ¶ 112.

6. Dependent Claim 7

7[a]: The display apparatus according to claim 1, wherein: said active elements are transistors forming pairs and arranged in a matrix pattern,

Utsugi's active elements (transistors Q_S and Q_I) satisfy this limitation. Utsugi discloses that these transistors comprise "*a pair of* reversely staggered a-SiTFT (amorphous silicon thin-film transistor)'s as a switching transistor and a current-controlling transistor . . . ." Ex. 1003, 5:50–56 (emphasis added). Utsugi further discloses that the transistors are "*arranged in the form of a matrix* between a plurality of signal electrode lines and a plurality of scan electrode lines," Ex. 1003, 4:5–21 (emphasis added), as shown in annotated Figure 3 below. Ex. 1007, ¶ 114.



> **7[b] one transistor of each of said pairs being a selection transistor which is turned on in response to an externally supplied address signal, and**

Utsugi's "switching transistor Q_S" satisfies this element, for the reasons provided for claim 4[a]. Ex. 1007, ¶ 117.

> **7[c] the other transistor of each of said pairs being a drive transistor, which is driven by a signal corresponding to image data supplied externally through said selection transistor while said selection transistor is on, for controlling a voltage to be applied to said organic electroluminescent layer;**

Utsugi's "current controlling transistor Q_I" satisfies this element, for the reasons provided for claim 4[b]. Ex. 1007, ¶¶ 119–120.

> **7[d]: said selection transistor of each of said pairs is connected to one of address lines and one of data lines, said address lines being formed over said substrate and being**

supplied with said address signal, and one of said data lines being formed over said substrate and being supplied with said image data; and

First, Utsugi discloses that its selection transistor (switching transistor Q_S) is connected to address lines, i.e., "scan electrode lines" 3_{N+1}, which supply the address signal as discussed for claim 4[a]. A POSA would understand that such a line would itself be supplied with the address signal (that is, in order for a line to carry an electrical signal, something would need to place the signal on the line, since the line is a passive wire which cannot generate its own signal). Ex. 1007, ¶ 122.

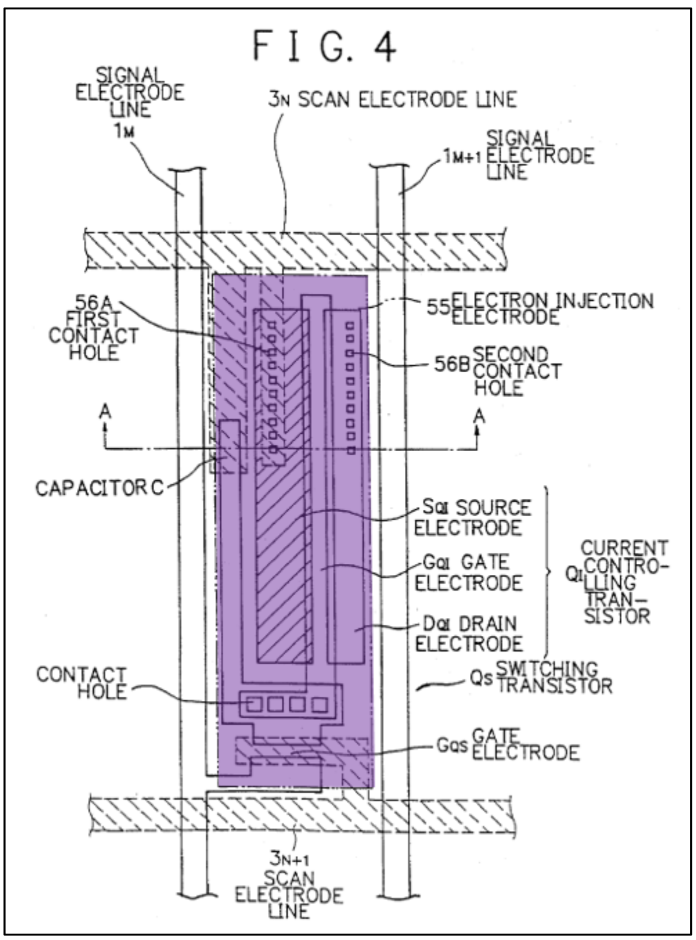
Second, Utsugi discloses that its drive transistor ("current controlling transistor Q_I") is connected to data lines, i.e., "signal electrode lines" 1_M, which supply the image data as discussed for claim 4[b]. Again, a POSA would understand that such a line would itself be supplied with the image data. Ex. 1007, ¶ 122.

Third, Utsugi discloses that these address lines (scan electrode lines) and data lines (signal electrode lines) are formed over the substrate (glass panel 50). *See* Ex. 1003, 7:20–25 ("First, on the glass base 50 is grown a Cr layer 200 nm thick. Then, a patterning process is executed for the scan electrode lines."); *id*., 7:35–40 ("Then, a Cr layer 100 nm thick is deposited and pattern-processed to provide the signal electrode line 1_M."); Ex. 1007, ¶ 123.

7[e]: said at least one first electrode is plural in number, and the plurality of first electrodes are arranged in a matrix

pattern in areas surrounded by said address lines and said data lines.

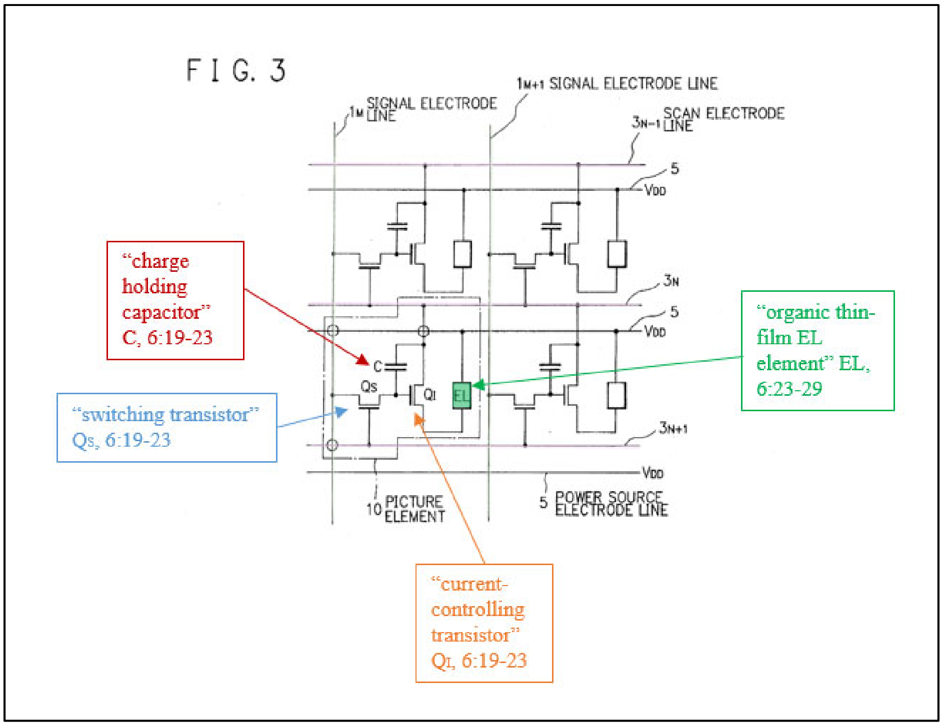
As shown in Figure 3, Utsugi discloses a plurality of picture elements 10. As shown in annotated Figure 4 below, each picture element comprises a first electrode, i.e., electron injection electrode 55 (purple), that is surrounded by the scan (address) and signal (data) electrode lines, i.e., that is "patterned like an independent i[s]land in each picture element region." Ex. 1003, 6:53–59. Given that each pixel has its own pixel electrode, the pixel electrodes are both plural in number and arranged in a matrix pattern. Ex. 1007, ¶ 125.



7. Dependent Claims 8 and 16

The display apparatus according to claim [1/15], wherein a constant voltage is applied to said second electrode.

Utsugi teaches a constant voltage applied to the second electrode (hole injection electrode 54). As shown in annotated Figure 3 below, the hole injection electrode 54 is connected to power source electrode line 5, labeled as V_{DD}. Ex. 1003, 6:43–47 ("[E]lectrode 54 corresponds to a power source electrode line 5 shown in Figure 3."). A person of ordinary skill in the art would understand that the power source line 5 V_{DD} is a constant DC voltage. Ex. 1007, ¶ 129; *see also* Ex. 1006 at App. D, p. 387 (defining V_{DD} as "Supply voltage, d.c."). In fact, Utsugi discloses an experiment of the first embodiment, wherein the power source line 5 applies a 7 V voltage across the EL structure. Ex. 1003, 8:32–40. In disclosing a single voltage value, Utsugi coveys that the power source line 5 V_{DD} applies a constant voltage at that value. Ex. 1007, ¶ 129.



8. Claim 15

15[preamble]: A display apparatus comprising:

To the extent the preamble is limiting, it is disclosed by Utsugi. Utsugi discloses a display apparatus, stating, for example, that "[t]he present invention relates . . . in particular to a current-controlled luminous element array of an active matrix type such as for a display purpose." Ex. 1003, 1:6–9; Ex. 1007, ¶ 131.

15[a]: a substrate;

Utsugi discloses a substrate, i.e., "glass base 50," upon which the remainder of the EL element is built. Ex. 1003, 6:37–40; Ex. 1007, ¶ 133.

15[b]: selection transistors formed over said substrate and arranged in a matrix pattern;

Utsugi discloses selection transistors formed over said substrate (glass base 50) and arranged in a matrix pattern. Utsugi discloses selection transistors, i.e., "switching transistor[s] Q_S." Ex. 1003, 6:19–23; Ex. 1007, ¶ 135. The switching transistors Q_S are "*arranged in the form of a matrix* between a plurality of signal electrode lines and a plurality of scan electrode lines." Ex. 1003, 4:5–21 (emphasis added). Utsugi discloses that switching transistor Q_S is formed over, i.e., on top of, glass base 50. Ex. 1003, 7:20–45; Ex. 1007, ¶ 135.

15[c]: drive transistors formed over said substrate and arranged in a matrix pattern, each of said drive transistors being connected to one of said selection transistors;

Utsugi discloses drive transistors formed over said substrate and arranged in a matrix pattern, each of said drive transistors being connected to one of said selection transistors.

First, Utsugi discloses drive transistors, i.e., "current-controlling transistor[s] Q_I." Ex. 1003, 6:19–23; Ex. 1007, ¶ 137.

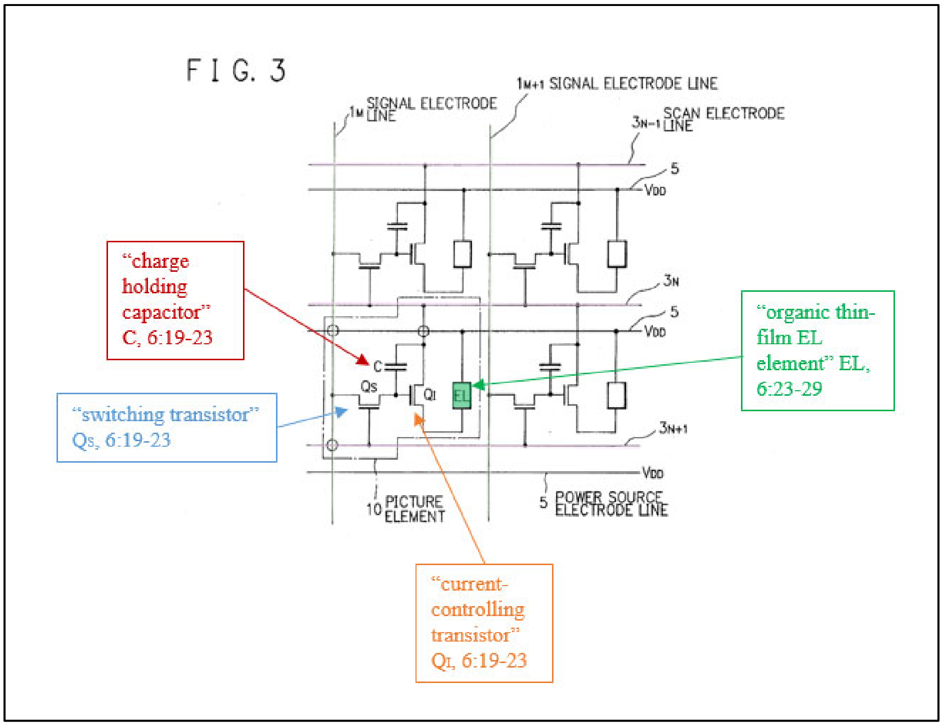
Second, Utsugi discloses that current-controlling transistor Q_I is formed over, i.e., on top of, glass base 50. Ex. 1003, 7:20–45; *see also id.*, Figure 5 (illustrating the gate, drain, and source electrodes, G_{QI}, D_{QI}, and S_{QI}, as formed over glass base 50); Ex. 1007, ¶ 137.

Third, Utsugi discloses that the drive transistors Q_S are "*arranged in the form of a matrix* between a plurality of signal electrode lines and a plurality of scan electrode lines." Ex. 1003, 4:5–21 (emphasis added); Ex. 1007, ¶ 137.

Finally, as shown in Figure 3, current-controlling transistor Q_I is connected to switching transistor Q_S, i.e., "a gate electrode of the current-controlling transistor and one signal electrode line have the switching transistor connected there[ ]between." Ex. 1003, 4:5–21; Ex. 1007, ¶ 137.

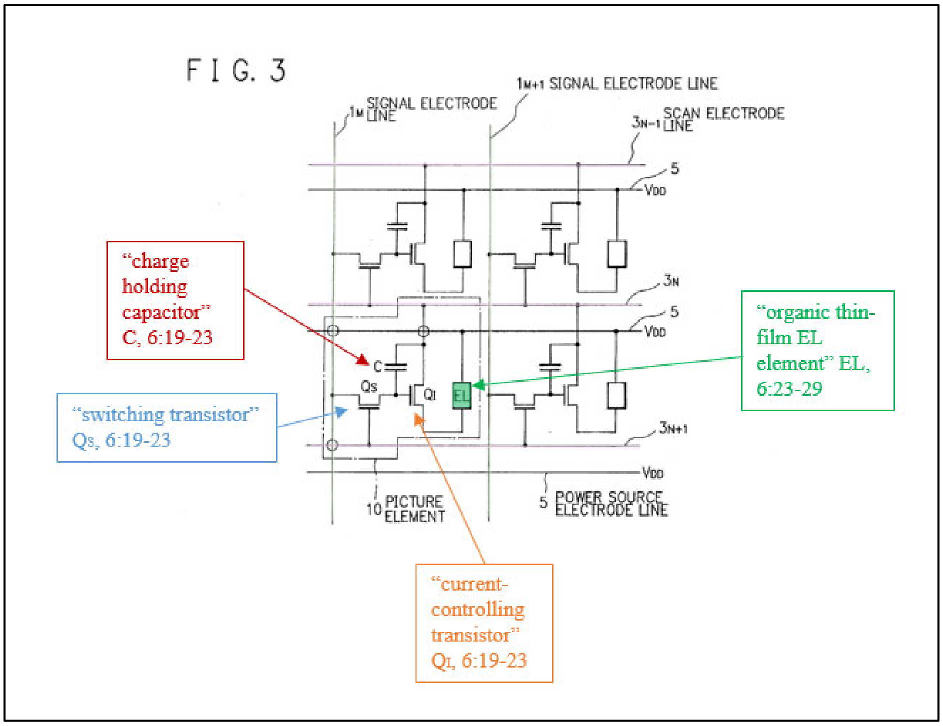
15[d]: address lines connected to said selection transistors and through which a signal for turning on said selection transistors is supplied;

Utsugi discloses address lines, i.e., scan electrode lines, connected to the selection transistors, i.e., switching transistors Q_S, through which a signal for turning on the switching transistors Q_S is supplied. As shown in annotated Figure 3 below, the gate of switching transistor Q_S is connected to scan electrode line 3_{N+1}. *See also* Ex. 1003, 7:9–12 ("For the switching transistor Qs in this picture element, the scan electrode line 3_{N+1} extending in the (N+1)-th row of the array provides a straight branch that constitutes a gate electrode G_{QS} of the transistor Q_S."). When "the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on." *Id.*, 8:11–16. Accordingly, the switching transistor is turned on in response to a signal from the scan electrode line. Ex. 1007, ¶ 139.



15[e]: data lines connected to said selection transistors, a signal which corresponds to image data being supplied to said drive transistors through said data lines and said selection transistors while said selection transistors are on;

Utsugi discloses data lines, i.e., signal electrode lines, connected to the switching transistors Q_S, a signal which corresponds to image data being supplied to said drive transistors through said data lines and said selection transistors while said selection transistors are on. Ex. 1007, ¶ 141. As shown in in annotated Figure 3 below, the source of switching transistor Q_S is connected to signal electrode line 1_M.



The data being sent on the signal electrode line corresponds to image date. *See, e.g.*, Ex. 1003, 3:66–4:4 ("It is therefore an object of the present invention to provide a current-controlled luminous element array of a high quality active matrix type having a significantly reduced tendency to image quality deteriorations."); Ex. 1007, ¶ 142. When "the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on," and image data from electrode line 1_M is "imposed via the switching transistor Q_S on the charge holding capacitor C" and the gate of current-controlling transistor Q_I. Ex. 1003, 8:11–16. Accordingly, the image data is supplied by the signal electrode line to the drive transistor, when the switching transistor is on. Ex. 1007, ¶ 141.

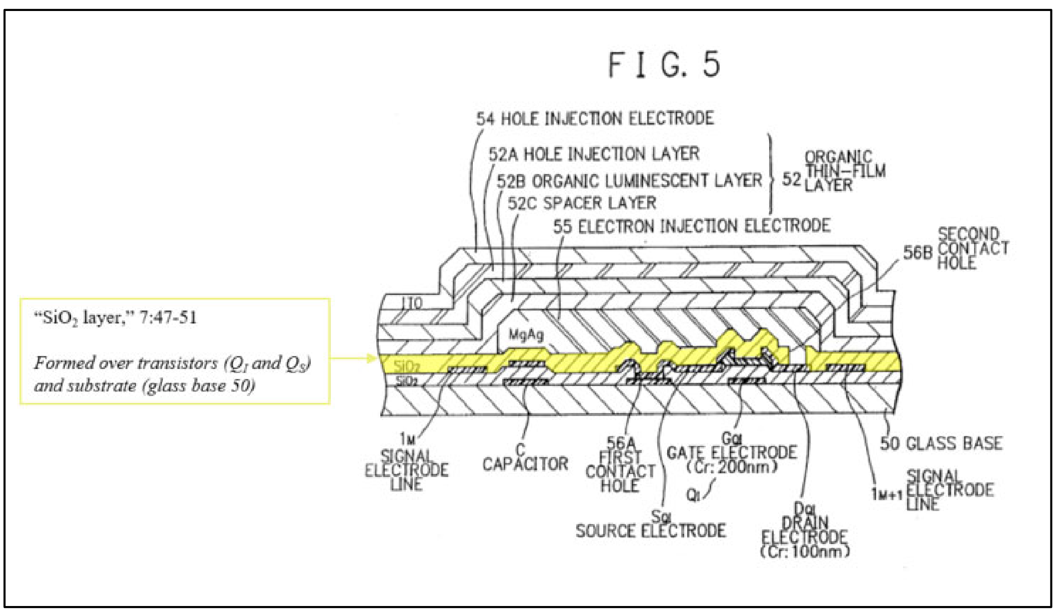
15[f]: an insulation film formed over said substrate so as to cover said drive transistors, said address lines and said data

lines, said insulation film having contact holes formed in correspondence with said drive transistors;

Utsugi discloses an insulation film, i.e., a SiO_2 layer, formed over said substrate so as to cover said drive transistors, said address lines and said data lines, said insulation having contact holes formed in correspondence with said drive transistors.

First, Utsugi discloses that after current-controlling transistor Q_I, scanning electrode lines 3_N, and signal electrode lines 1_M are formed on the substrate, Ex. 1003, 7:20–45, "a SiO_2 layer is let grow 200 nm," Ex. 1003, 7:46–51; Ex. 1007, ¶ 145.

Second, as shown in annotated Figure 5 below, the SiO_2 layer covers current-controlling transistor Q_I and signal electrode line 1_M. Ex. 1007, ¶ 146.



The ’450 patent describes the SiO_2 layer as being deposited over the “luminous element array,” *see* Ex. 1003, 7:16–19, after scanning electrode line 3_N has been formed. Figure 5 depicts the SiO_2 layer as being continuous, with no indication that it is patterned, apart from having the second contact hole 56B. *Id.*, 7:47–52; Ex. 1007, ¶ 147. Notably, the scanning electrode line 3_N is formed in the same metal layer as the lower electrode of the capacitor C and the gate electrode G_{QI}. Ex. 1003, 7:20–25. As shown in Figure 5, both of these elements are covered by the SiO_2 layer. A POSA would appreciate that the scanning electrode line 3_N would be similarly covered. Ex. 1007, ¶ 147.

Third, as shown in Figure. 5 above, a contact hole 56B is formed in the SiO_2, so as to allow contact between the electron injection electrode 55 and the drain electrode D_{QI} of the current-controlling transistor Q_I. Ex. 1003, 7:46–51; Ex. 1007, ¶ 148.

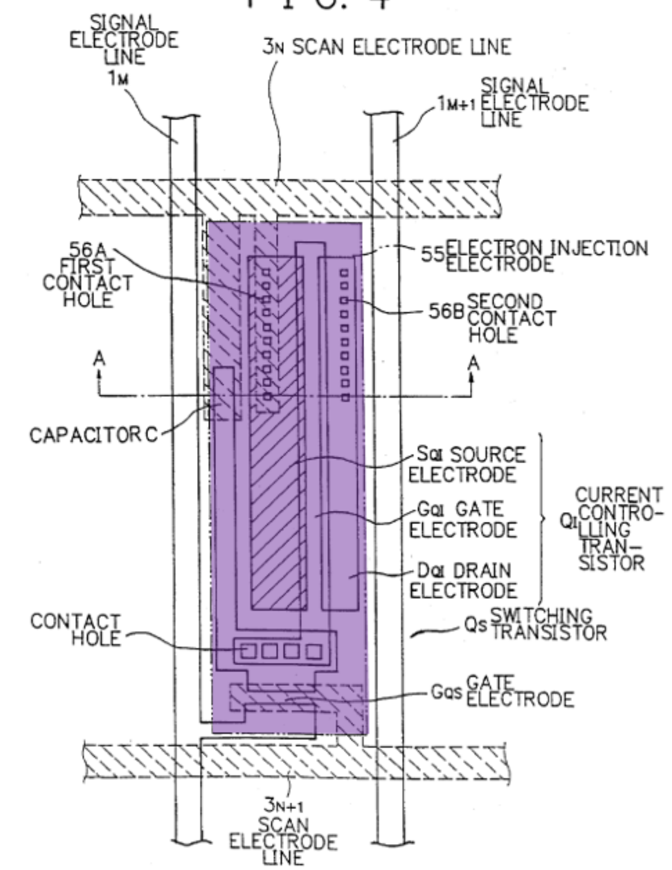
15[g]: first electrodes made of a material which shields visible light, and formed on said insulation film so as to cover said selection transistors and said drive transistors, said first electrodes being arranged in a matrix pattern in areas surrounded by said address lines and said data lines, and being connected to said drive transistors through said contact holes;

Utsugi discloses this limitation. First, Utsugi discloses that the electron injection electrode is made of a “metallic material MgAg,” Ex. 1003, 6:47–50. A metallic electrode made of MgAg would be reflective and shield visible light. Ex.

1007, ¶ 150. Indeed, the ’450 patent identifies magnesium-based metals, such as MgAg and MgIn as suitable materials for forming the first electrode (cathode), which is described as shielding visible light. Ex. 1001, 8:49–54, 17:25–27.

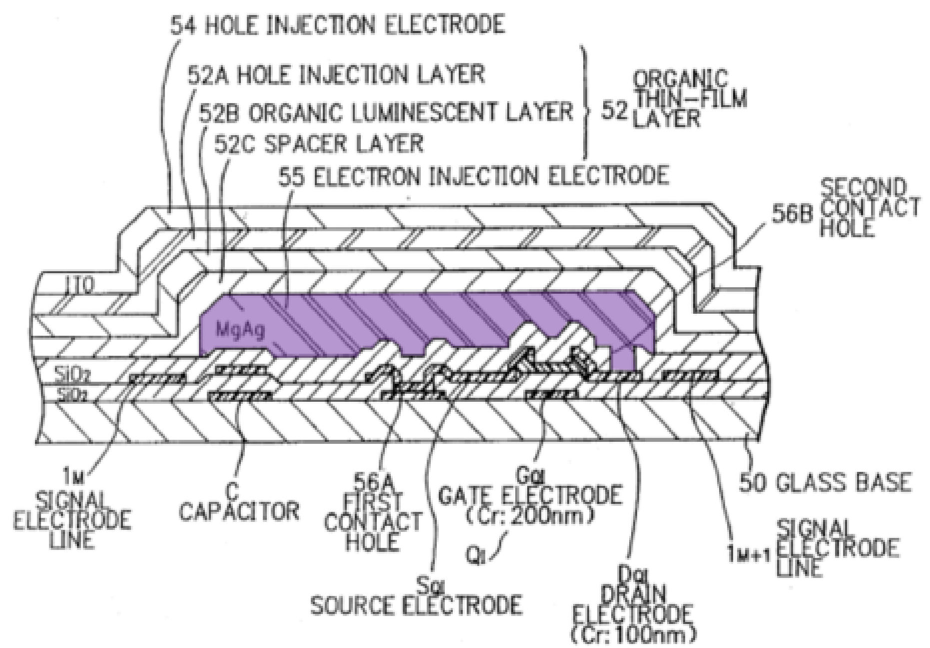
Second, as shown in annotated Figure 4 below, the electron injection electrode 55 (purple) is formed so as to cover almost the entirety of the pixel, including both the switching transistor Q_S and the current-controlling transistor Q_I. Ex. 1007, ¶ 151. The electron injection electrode 55 is “*arranged in the form of a matrix* between a plurality of signal electrode lines and a plurality of scan electrode lines.” Ex. 1003, 4:5–21 (emphasis added).

FIG. 4



Third, Utsugi discloses that the first electrode is connected to the current-controlling transistor Q_I through a contact hole, as shown in Figure 5 and as described in the manufacturing steps: "etching to open the second contact holes 56B for intercommunication between the source electrode S_{QI} of the current-controlling transistor Q_I and the electron injection electrode 55." *Id.*, 7:46–51; Ex. 1007, ¶ 152.

FIG. 5

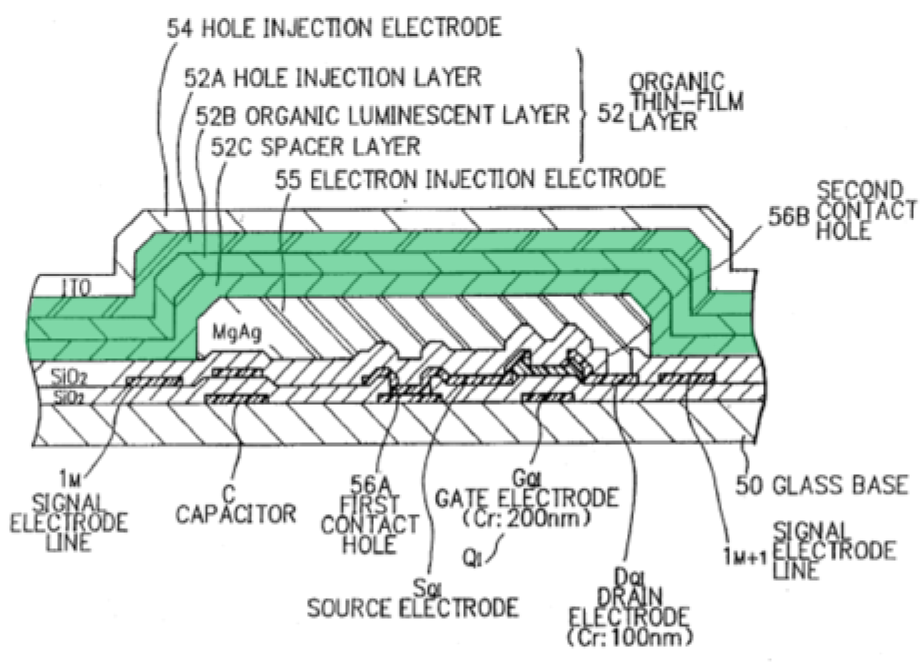


15[h]: an organic electroluminescent layer formed on said first electrodes which covers said selection transistors and said drive transistors and including at least one layer which emits light in accordance with an applied voltage;

Utsugi discloses this limitation. First, as shown in annotated Figure 5 below, Utsugi discloses an organic electroluminescent layer, i.e., organic thin-film layer 52, formed on said first electrode (electron injection electrode 55). Ex. 1007, ¶ 155.

Organic thin-film layer 52, includes at least one layer which emits light in accordance with an applied voltage—i.e., organic luminescent layer 52B. *See* 1003, 6:59–63 ("[W]hen an arbitrary picture element is selected to be driven, there develops an electric field acting thereon, causing the organic luminescent layer 52B to luminesce, externally emitting flux of light through the transparent electrode 54."); *see also id*., 8:20–28 ("[A]n electric current runs through an established conducting route: the power source electrode line 5→the luminescent element EL→the transistor Q_I→the scan electrode line causing the luminescent element EL to luminesce."); Ex. 1007, ¶ 155.

FIG. 5

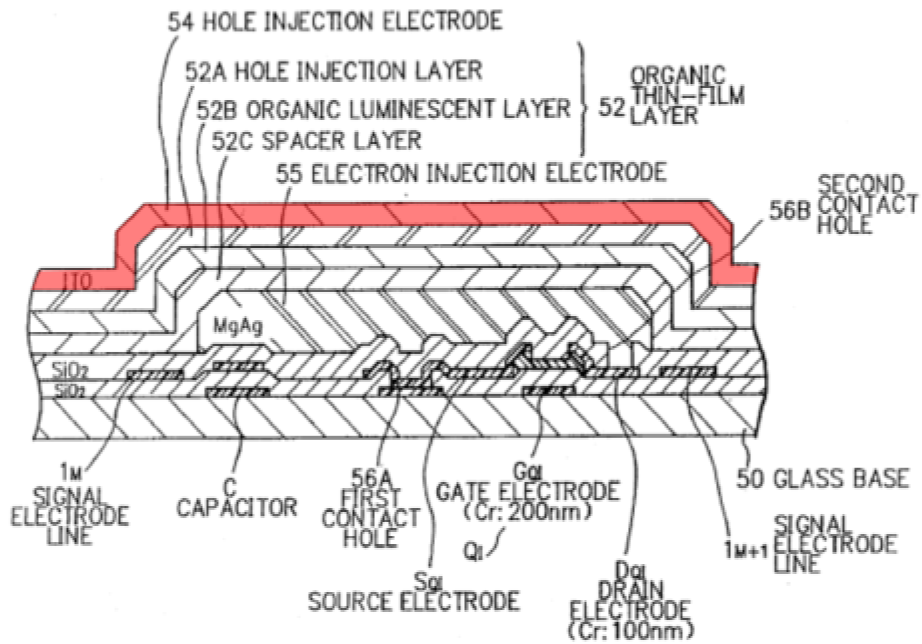


Second, Utsugi discloses that the organic thin-film layer 52, as well as the remainder of the EL structure, is formed so as to cover the entire picture element region, including the active elements (transistors Q_S and Q_I): "The luminescent element EL as a layered organic thin-film EL element extends over the capacitor C and the transistors Q_I and Q_S, covering substantially the entirety of the picture element region." Ex. 1003, 6:23–29; *see also id*., Ex. 1003, 6:53–59 ("[T]he organic thin-film layer 52 and the hole injection electrode 54 are made common to the whole picture elements of the luminous element array, i.e., formed over the entire region of a display panel."); Ex. 1007, ¶ 156.

15[i]: a second electrode formed on said organic electroluminescent layer which covers said selection transistors and said drive transistors;

Utsugi discloses this limitation. First, as shown in annotated Figure 5 below, Utsugi discloses a second electrode, i.e., hole injection electrode 54, formed on said organic electroluminescent layer, (organic thin-film layer 52). Ex. 1007, ¶ 158.

FIG. 5



Second, as described above for element 15[h], Utsugi discloses that the hole injection electrode, as well as the remainder of the EL structure, is formed so as to cover the entire picture element region, including the active elements (transistors Q_S and Q_I): "The luminescent element EL as a layered organic thin-film EL element extends over the capacitor C and the transistors Q_I and Q_S, covering substantially the entirety of the picture element region." Ex. 1003, 6:23–29; *see also id.*, Ex. 1003, 6:53–59 ("[T]he organic thin-film layer 52 and the hole injection electrode 54 are made common to the whole picture elements of the luminous element array, i.e., formed over the entire region of a display panel."); Ex. 1007, ¶ 159.

15[j]: a first driver circuit for selectively supplying said address signal to said address lines in sequence; and

Utsugi discloses this limitation. Utsugi discloses that "[i]n the active matrix type luminous element array, the row selection is performed by sequentially selecting corresponding one of row-addressed scan electrode lines." Ex. 1003, 8:59–62. While the figures in Utsugi do not explicitly show the driver circuit used to select the scan electrode line, it would be understood that such a circuit would necessarily be present as part of the Utsugi display—a circuit would be necessary to perform the described function—in particular, given that the claim does not require a particular structure for such drive circuitry. Ex. 1007, ¶¶ 161–162.

15[k]: a second driver circuit for supplying said image data to said data lines.

Utsugi discloses this limitation. Utsugi discloses signal electrode lines 1_M for supplying image data to the current-controlling transistors Q_I. *See, e.g.*, Ex. 1003, Figure 3. While the figures in Utsugi do not explicitly show the driver circuit used to supply the image data, it would be understood that such a circuit would necessarily be present as part of the Utsugi display—a circuit would be necessary to perform the illustrated function—in particular, given that the claim does not require a particular structure for such drive circuitry. Ex. 1007, ¶¶ 164–165.

B. Ground II: Claims 1–2, 4–8, and 15–16 Are Obvious Over Utsugi.

To the extent there is any question whether Utsugi anticipates claims 1–2, 4–8, and 15–16, these claims would have been obvious to a POSA based on Utsugi for

substantially similar reasons. As shown below, Utsugi teaches or at a minimum suggests all elements of these claims, and the claims would have been obvious under 35 U.S.C. § 103.

1. Claim 1

1[preamble]–1[b]

Utsugi teaches (or at a minimum suggests) the claim elements required by limitations 1[preamble] through 1[b] for the reasons provided in Ground I.

1[c]: an insulation film formed over said substrate so as to cover said active elements, said insulation having at least one contact hole;

As discussed above in Ground I, a POSA would have understood that Utsugi discloses an insulation formed over the substrate covering both of the active elements (transistors Q_S and Q_I). However, even if Utsugi did not disclose this claim element, it would have been obvious to a POSA to form the insulation film so as to cover the active elements, including for many of the same reasons discussed in Ground I. Ex. 1007, ¶¶ 168–170.

In particular, given that Utsugi discloses that the electron injection electrode 55 covers both active elements, *see* Fig. 4 (illustrating electron injection electrode 55 covering transistors Q_S and Q_I), a POSA would understand that it would have been obvious, if not necessary, to include an insulation layer over both active

elements, so as to prevent the metal layers of the active elements from coming into contact with the electron injection electrode. Ex. 1007, ¶ 168.

This would be nothing more than applying a known technique to a known device. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007). A POSA would have understood that the result would have been predictable, as evidenced by the '450 patent itself, which teaches that the "related art" at the time of the alleged invention already made use of a passivation film 104 that covered both transistors, as shown in annotated Figure 23 below.[5] Ex. 1007, ¶ 169. As noted by the '450 patent, it was known prior to the alleged invention that the passivation layer could further "prevent the occurrence of a parasitic capacitance in the thin film transistors." Ex. 1001, 2:53–56.

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[5] The '450 patent appears to state in error that "Fig. 23 is a sectional view of the display apparatus illustrated in FIG. 21." Ex. 1001, 5:14–15. The context of the patent makes clear that Figure 23 is actually intended to be a cross-section of Figure 22. *See id.*, 1:47–65.

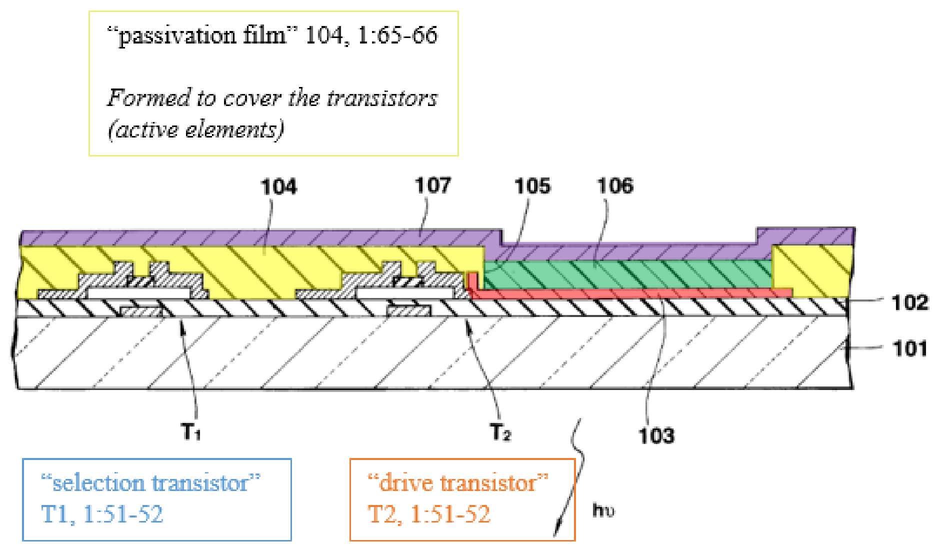


FIG.23

1[d]–1[f]

Utsugi teaches (or at a minimum suggests) the claim elements required by limitations 1[d] through 1[f] for the reasons provided in Ground I.

2. Dependent Claims 2 and 4–7

Utsugi teaches (or at a minimum suggests) the elements of these dependent claims for the reasons provided in Ground I.

3. Dependent Claims 8 and 16

The display apparatus according to claim [1/15], wherein a constant voltage is applied to said second electrode.

As discussed above in Ground I, a POSA would have understood that Utsugi discloses applying a constant voltage to the second electrode (hole injection electrode 54). However, even if Utsugi did not to disclose these elements, it would

have been obvious to a POSA to implement this limitation, including for many of the same reasons discussed in Ground I. Ex. 1007, ¶¶ 171–174.

A POSA would understand that there are only two options for the voltage applied to the second electrode—a constant voltage or an alternating voltage. Ex. 1007, ¶ 171. As Utsugi notes, the purpose of the voltage applied to the second electrode is to create a current flow through the luminescent element EL, causing the luminescent element EL to emit light. *See* Ex. 1003, 6:59–63 ("[W]hen an arbitrary picture element is selected to be driven, there develops an electric field acting thereon, causing the organic luminescent layer 52B to luminesce, externally emitting flux of light through the transparent electrode 54."); *see also id*., 8:20–28 ("[A]n electric current runs through an established conducting route: the power source electrode line 5→the luminescent element EL→the transistor Q_I→the scan electrode line causing the luminescent element EL to luminesce."). A POSA would understand that a constant voltage would be necessary to keep the image displayed for the entirety of a full frame, without a flicker, and to prevent a perceivable change in brightness. Ex. 1007, ¶ 172.

Use of a constant voltage would be nothing more than the selection of single solution from "a finite number of identified, predictable solutions." *KSR*, 550 U.S. at 421. A POSA would have had a reasonable expectation of implementing a constant voltage, as evidenced by the '450 patent itself, which teaches that the

"related art" at the time of the alleged invention already made use of a "constant voltage line VL," Ex. 1001, 1:56–58, as shown in annotated Figure 22 below.

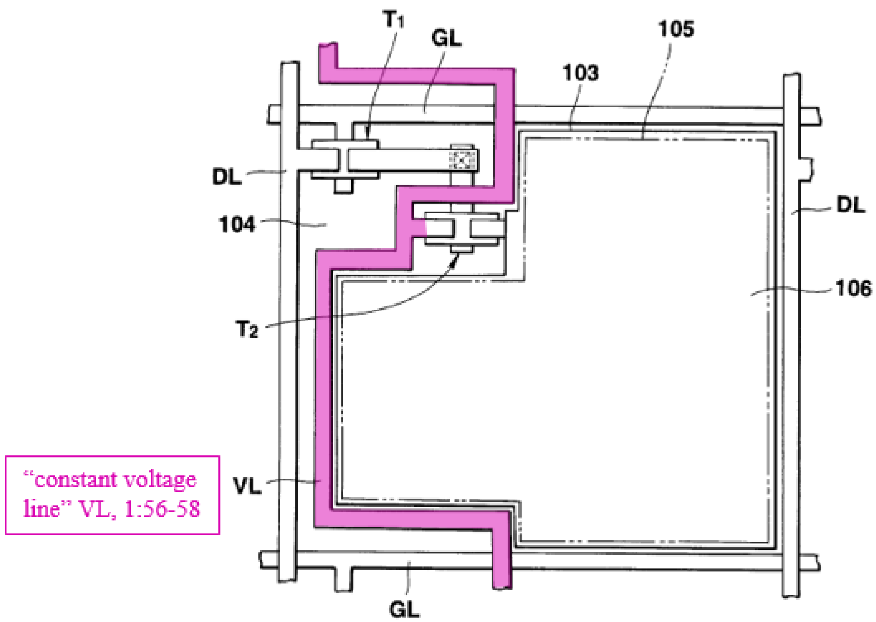


FIG.22

4. Claim 15

15[preamble]–15[e]

Utsugi teaches (or at a minimum suggests) the claim elements required by limitations 15[preamble] through 15[e] for the reasons provided in Ground I.

15[f]: an insulation film formed over said substrate so as to cover said drive transistors, said address lines and said data lines, said insulation film having contact holes formed in correspondence with said drive transistors;

As discussed above in Ground I, a POSA would have understood that Utsugi discloses an insulation film (SiO_2 layer) formed over the substrate (glass base 50) so

as to cover the address lines (scanning electrode lines 3_N), in addition to the drive transistors (current-controlling transistor Q_I) and the data lines (signal electrode line 1_M). However, even if Utsugi did not disclose that the SiO_2 layer covered the scanning electrode line 3_N, it would have been obvious to a POSA to implement this limitation, including for many of the same reasons discussed in Ground I.

Utsugi describes the SiO_2 layer as being deposited over the "luminous element array," Ex. 1003, 7:16–19, after scanning electrode line 3_N has been formed. While Utsugi teaches that this layer can be patterned, it discloses doing so only for the second contact hole 56B. Ex. 1003, 7:46–51. Utsugi does not state or suggest that the SiO_2 layer is patterned so as not to cover scanning electrode lines 3_N. A POSA would expect that, if the insulation film underwent further removal, the process would be explicitly described. Ex. 1007, ¶ 176. Notably, the scanning electrode line 3_N is formed in the same metal layer as the lower electrode of the capacitor C and the gate electrode G_{QI}. Ex. 1003, 7:20–25. As shown in Figure 5, both of these elements are covered by the upper SiO_2 layer. A POSA would have no reason, absent a teaching in Utsugi, to undertake the effort and cost of a further processing step of patterning the SiO_2 layer so as not to cover the scanning line 3_N. Ex. 1007, ¶ 176.

15[g]–15[i]

Utsugi teaches (or at a minimum suggests) the claim elements required by limitations 15[g] through 15[i] for the reasons provided in Ground I.

15[j/k]: a [first/second] driver circuit for [selectively supplying/supplying] said [address signal/image data] to said [address lines in sequence/data lines]; and

As discussed above in Ground I, Utsugi discloses the use of address lines and data lines. A POSA would understand that driving circuits for supplying address signals and image data to said lines, respectively, would have been inherent features of the Utsugi display. However, even if Utsugi did not disclose this claim element, it would have been obvious to a POSA (at a minimum) to use driving circuits to supply address signals and image data to the address and data lines, respectively, including for many of the same reasons discussed in Ground I. Ex. 1007, ¶¶ 177–179.

As disclosed by Utsugi, it was known that active matrix displays could be driven by "a so-called simple matrix line sequencing manner," where "the scan lines . . . employed as common lines are sequentially selected one by one, and each selected scan line continuously applies a positive drive pulse voltage V_D to all signal lines . . . during the selected period of time." Ex. 1003:1:63–2:2.

A POSA at the time of the alleged invention would have understood that corresponding circuitry would have been needed to implement this type of driving pattern and thus would have used it for Utsugi. Ex. 1007, ¶ 177.

Indeed, during prosecution, the Examiner rejected original claim 16 (issued claim 15) over a combination including U.S. Patent No. 5,847,516 (Ex. 1011, "Kishita"), noting that "scan and data line drive circuits [as taught by Kishita] are an essential element in matrix type display devices . . . , and the incorporation to said drive circuits in matrix type display devices is understood." Ex. 1002, 160 (August 31, 1999 Non-Final Rejection). The applicants did not dispute the Examiner's characterization, but rather distinguished Kishita on the unrelated ground that it disclosed *inorganic* EL elements. *Id.*, 3005 (November 30, 1999 Amendment).

Active matrix displays, whether they use organic or inorganic EL elements, require circuitry to active the individual address line and to supply image on the data lines. Ex. 1007, ¶ 34. If Utsugi is not understood to inherently disclose such driver circuitry, then there would be a clear motivation and reasonable expectation of success in modifying Utsugi to include such circuitry. These modifications would have been well within the skill of a POSA. Ex. 1007, ¶ 178. A POSA would have been aware that drive circuits are an essential element in matrix displays (as explained by the Examiner and confirmed by Kishita) and would be used to provide address signals and image data to an active matrix like that used in Utsugi. Ex. 1007,

¶ 178. Indeed, a POSA would have appreciated that some type of circuit would be required to provide the signals explicitly discussed in Utsugi, and this circuitry would be connected to the ends of the scan electrode and signal electrode lines. Ex. 1007, ¶¶ 177–178. This would be nothing more than the "application of a known technique [the use of a circuitry to provide address signals and image data] to a piece of prior art ready for the improvement [Utsugi]." *KSR*, 550 U.S. at 417.

C. Ground III: Claim 3 Is Obvious Over the Combination of Utsugi and Manabe.

1. Dependent Claim 3

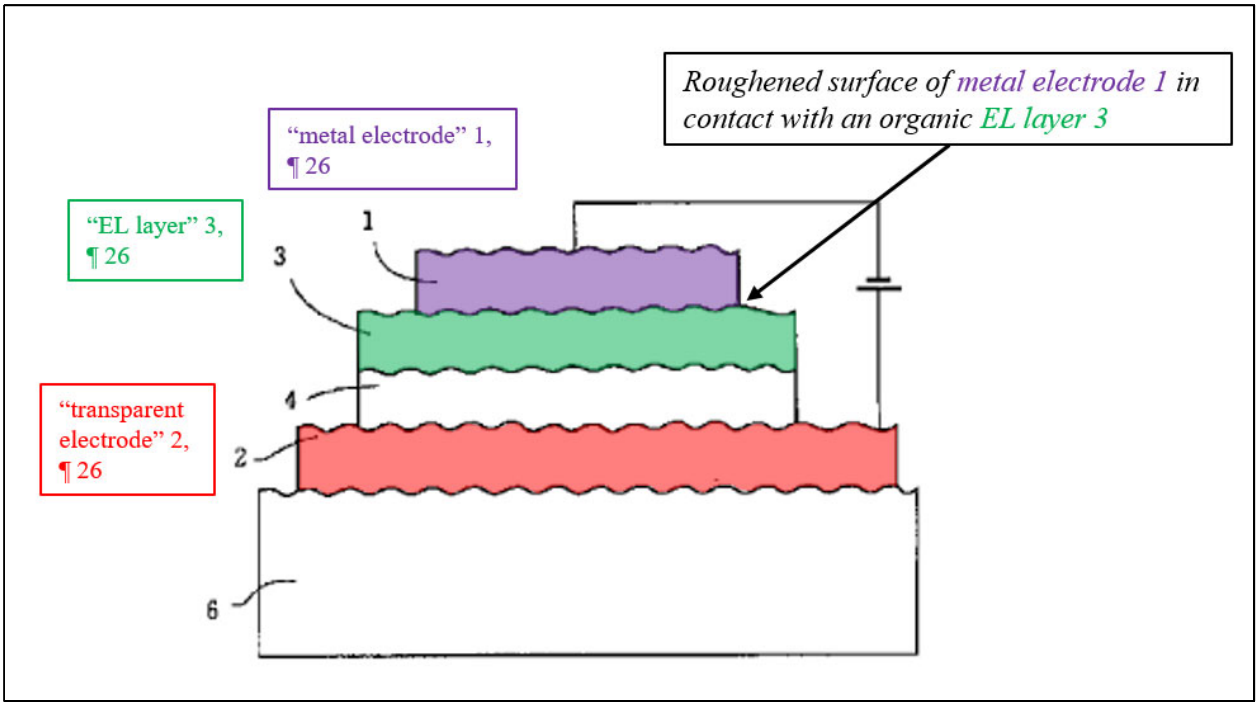
The display apparatus according to claim 1, wherein said at least one first electrode has a rough surface which is in contact with said organic electroluminescent layer.

Claim 3 requires that the first electrode (i.e., the cathode) has a "rough surface" in contact with the EL layer. This would have been obvious to a POSA.

As the Examiner found during prosecution, "specifying an electrode having a rough surface to be in contact with the electroluminescent layer is in common practice and well known in the art." Ex. 1002, 159 (August 31, 1999 Non-Final Rejection). The Examiner recognized the obviousness of this limitation even without identifying a specific reference, as a "first electrode having a rough surface which is in contact with the electroluminescent layer is an [*sic*] design/manufacturing choice." *Id*. The applicants did not dispute this finding, even

when they disputed other of the Examiner's findings. *See generally* Ex. 1002, 294–307 (November 30, 1999 Amendment).

Additionally, as shown in Figure 1 of Manabe below, Manabe discloses an EL structure comprising a "metal electrode" 1, an organic "light emitting layer" 3, and a "transparent electrode" 2, and teaches benefits of the metal electrode having a rough surface in contact with the organic electroluminescent layer. Ex. 1004, ¶ 26; Ex. 1007, ¶¶ 181–183.



Manabe teaches that "roughening of the surface . . . of the metal electrode in contact with the organic EL layer [i.e., the cathode] causes slight differences in the light path from light sources within the light emission layer causing averaging of the interference effect and reducing angle dependence and film thickness dependence."

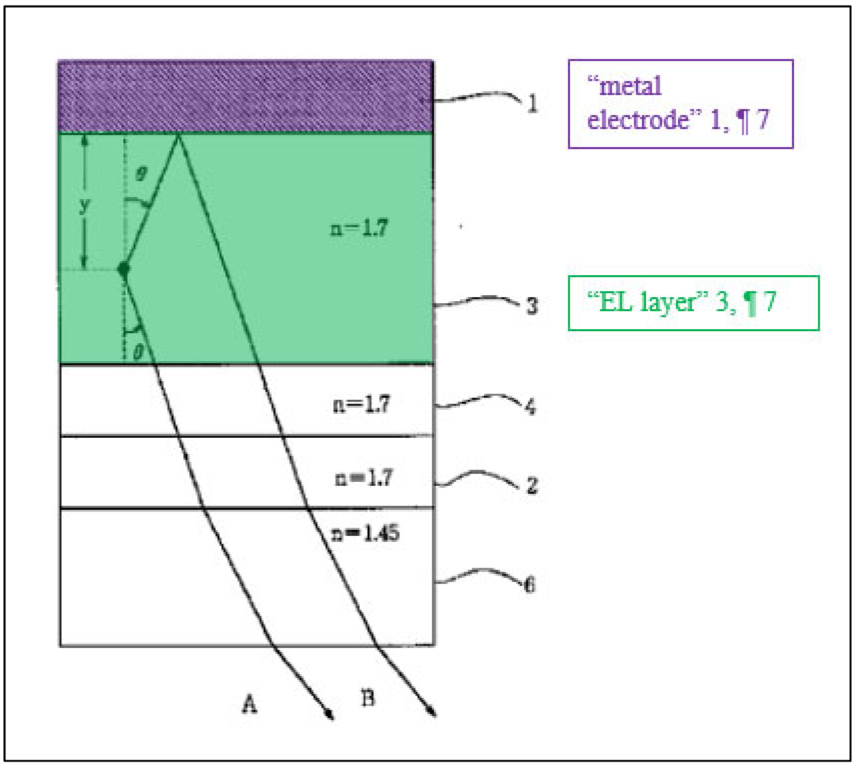
Ex. 1004, ¶ 24; *see also id.*, ¶ 34 (explaining that the "interference effect is averaged and angle dependence and membrane thickness dependence is reduced by roughening . . . the surface in contact with the organic EL layer of the metal electrode to cause differences in optical path variations from light emitting points inside the light emitting layer."); Ex. 1007, ¶ 183. Thus, Manabe teaches that roughening the surface of the metal electrode in contact with the organic EL layer will improve display quality. Ex. 1007, ¶ 183.

Accordingly, claim 3 would have been obvious based on the combination of Utsugi's display structure with the roughened metal electrode of Manabe. Ex. 1007, ¶¶ 184–186.

A POSA would have been motivated to use the roughened electrode of Manabe with Utsugi's display structure. Utsugi discloses organic EL structures for use in displays. *See, e.g.,* Ex. 1003, 1:17–23. A POSA would understand that a particularly important aspect of display design is optimizing the display's viewing angle, i.e., the angle at which the display can be viewed with acceptable visual performance. Ex. 1007, ¶ 180.

As shown in annotated Figure 5 below, Manabe addresses and solves a problem with the viewing angle of a display, where light from the electroluminescent layer is emitted directly to the viewer (path "A"), but also is reflected off of an electrode prior to being received by the viewer (path "B"). The result is a decrease

in luminance at various viewing angles. Ex. 1007, ¶¶ 181–182. Given that Utsugi incorporates a reflective first electrode (cathode), a POSA would recognize Utsugi as having the same problem. Ex. 1007, ¶ 185. As described above, Manabe solves this problem by roughening the metal electrode 1 at the interface between the metal electrode 1 and the EL layer 3. Ex. 1004, ¶ 34; Ex. 1007, ¶ 183.



Accordingly, Manabe provides an express teaching, suggestion, or motivation for a POSA to use its roughened electrode structure to improve a display's viewing angle, and thus its overall performance. Ex. 1007, ¶¶ 184–185. The use of Manabe's teaching in this manner constitutes nothing more than "application of a known technique [Manabe's teaching of using a roughened electrode] to a piece of prior art ready for the improvement [Utsugi's active matrix organic electroluminescent

display].” *KSR*, 550 U.S. at 417; *see also id.* at 415–19 (obvious to implement known techniques to improve similar devices and methods in known ways to yield predictable results, especially where some teaching, suggestion or motivation exists to do so).

It would have been straightforward to implement the roughened electrode of Manabe in the display structure of Utsugi. The metal electrode 1 of Manabe is made of magnesium, in particular MgAl, which is similar in composition to the Mg and MgAg electrodes of Utsugi. Ex. 1004, ¶ 26; Ex. 1003, 9:9–13; Ex. 1007, ¶ 185. Further, Manabe recognizes that electrodes may be made of magnesium, silver, or alloys thereof, which would include the MgAg electrode of Utsugi. Ex. 1004, ¶ 3. A POSA would understand from Manabe that the MgAg electrode described in Utsugi may be “roughened” in the same manner as the metal electrode described in Manabe. Ex. 1007, ¶ 185. A POSA would have been aware of numerous methods for doing so, including, for instance, chemical etching or abrasive techniques, like the use of fluorate or sandblast treatments described in Manabe for use with the glass substrate. Ex. 1004, ¶ 28; Ex. 1007, ¶ 185.

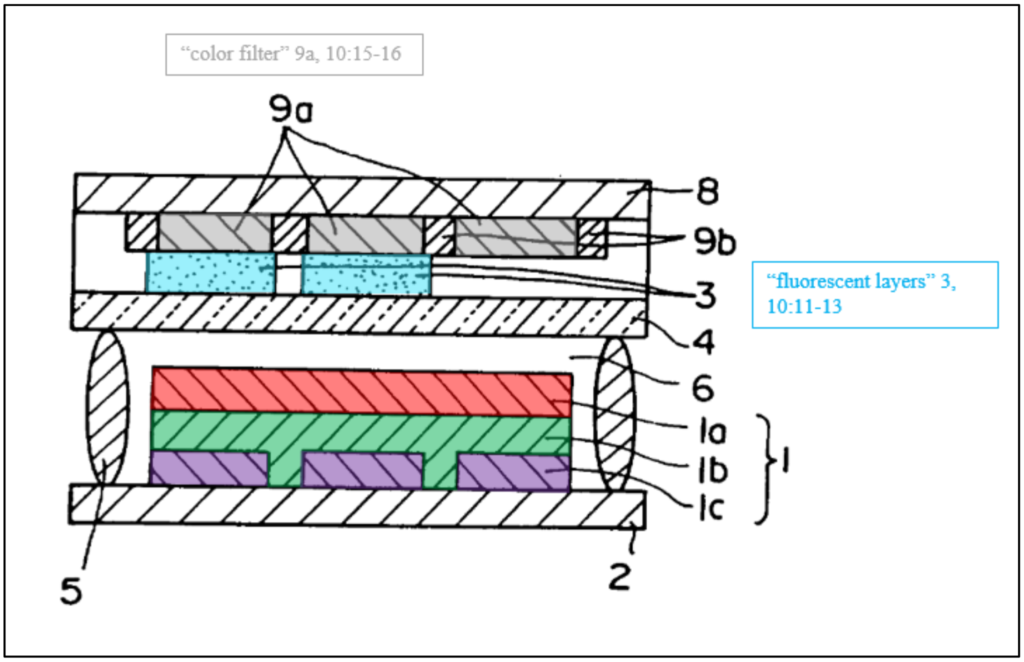
Thus, a POSA would have been motivated to modify Utsugi by adding Manabe’s roughened electrode to obtain the known improvements in viewing angle of an organic EL display, with a reasonable expectation of success, and modifying

Utsugi to implement roughened electrodes according to Manabe would have been well within the skill of a POSA. Ex. 1007, ¶¶ 184–185.

D. Ground IV: Claims 9, 11–13, and 17–18 Are Obvious Over the Combination of Utsugi and Eida.

Dependent claims 9, 11–13, 17, and 18, which further specify the use of one or more "wavelength conversion layer(s)" and "filter(s)," would have been obvious based on the combination of Utsugi and Eida.

Eida teaches the use of both wavelength conversion layers and color filters in an organic EL device. For example, as shown in annotated Figure 5 below, Eida's "first invention" includes two "fluorescent layers 3 which emit rays of fluorescent light of different colors . . . to obtain emitted light of the three primary colors (RGB)"—i.e., these layers convert the light's wavelength. Ex. 1005, 10:11–13. Additionally, "a color filter 9a may be arranged on each of the fluorescent layers 3 to control the fluorescent colors and thereby to promote the color purity." Ex. 1005, 10:15–16. These layers and filters are formed over an EL structure that (as in Utsugi), includes a first electrode, an organic EL layer, and a transparent second electrode. Accordingly, Eida allows for the creation of a multi-color or full-color display in such an organic EL device. Ex. 1005, 1:5–8; Ex. 1007, ¶ 191.



As explained in the following subsections, a POSA would have had reason to combine Eida's teachings with Utsugi, in a manner that would satisfy claims 9, 11–13, and 17–18.

1. Motivation to Combine Eida with Utsugi

A POSA would have been motivated to use Eida's wavelength conversion layers and color filters in connection with Utsugi's display structure. Ex. 1007, ¶ 192. Utsugi explains that organic thin-film EL structures were "attracting attention[] for the possibility of realizing an inexpensive *full-colored wide* display that would be difficult using an inorganic thin-film EL element or an LED." Ex. 1003, 1:17–23 (emphasis added). Utsugi teaches a specific structure for improving the efficiency of an OLED display, but does not provide details on the color aspect. Thus a POSA would have had a reason to look to other references, such as Eida, that

specifically addressed techniques for achieving or optimizing a multi-color or full-color display. Ex. 1007, ¶ 191.

Eida—and its "first invention" in particular—teaches an approach for achieving a full-color display in the same type of display as Utsugi—i.e., a top-emitting, organic electroluminescent device. Eida describes specific advantages of its approach of using wavelength conversion layers and color filters together (as compared with conventional approaches which simply placed RGB filters over white light). Ex. 1007, ¶¶ 193–195.

As Eida explains, its wavelength-converting "fluorescent layer has the advantage that multi-color light emission which is higher in efficiency than in the case of installing a color filter can be anticipated." Ex. 1005, 3:8–9. The conventional use of color filters alone can reduce the luminance of the light of each color to one third of the light emitted from the electroluminescent layer, *id.*, 2:24–25, whereas the use of color conversion layers can increase the efficiency upwards of 64%, *id.*, 3:8–15; Ex. 1007, ¶ 194.

Eida further teaches that color filters can be used together with its fluorescent layers "to control the fluorescent colors and thereby to promote the color purity." Ex. 1005, 10:15–16, 38:4–12 (Notably, the '450 patent implements color filters for the same function, i.e., to increase color purity.); Ex. 1001, 13:11–18; Ex. 1007, ¶ 195.

Eida thus provides an express teaching, suggestion, or motivation for a POSA to use the wavelength conversion layers and color filters of its "first invention" in order to optimize a multi-color light emission apparatus suitable for use in multi-color or full-color displays. Ex. 1007, ¶ 192. And the use of Eida's teaching in this manner constitutes nothing more than the "application of a known technique [Eida's teaching of using color conversion layers in conjunction with color filters in an organic electroluminescent display] to a piece of prior art ready for the improvement [Utsugi's active matrix organic electroluminescent display]." *KSR*, 550 U.S. at 417; *see also id.* at 415–19 (obvious to implement known techniques to improve similar devices and methods in known ways to yield predictable results, especially where some teaching, suggestion or motivation exists to do so).

It would have been straightforward for a POSA to implement the wavelength conversion layers and color filters of Eida's "first invention" in the display structure of Utsugi. Such a modification would be implemented, for example, by forming the color conversion layers and color filters of Eida over the EL structure of Utsugi. Ex. 1007, ¶¶ 196–198. This may be done as shown in the first invention of Eida, using "sealing" techniques, as well as an additional substrate to support the color conversion layers and color filters. Ex. 1007, ¶ 198. A POSA would recognize that alternative fabrication techniques may also be used, including, for example, using an inorganic oxide layer, adhesive layer, and fluorescent protective layer, as

described in the second invention of Eida. Ex. 1007, ¶ 198. As noted by Eida, the color filters may be formed "by performing prescribed patterning on prescribed positions of a material selected from known materials, by photolithography method or printing method." Ex. 1005, 36:7–9; Ex. 1007, ¶ 197. Thus, a POSA would be motivated to improve Utsugi's display by adding Eida's wavelength conversion layers and color filters, with a reasonable expectation of success and modifying Utsugi's active matrix organic EL structure array using the teachings of Eida would have been within the skill of a POSA. Ex. 1007, ¶¶ 192–198.

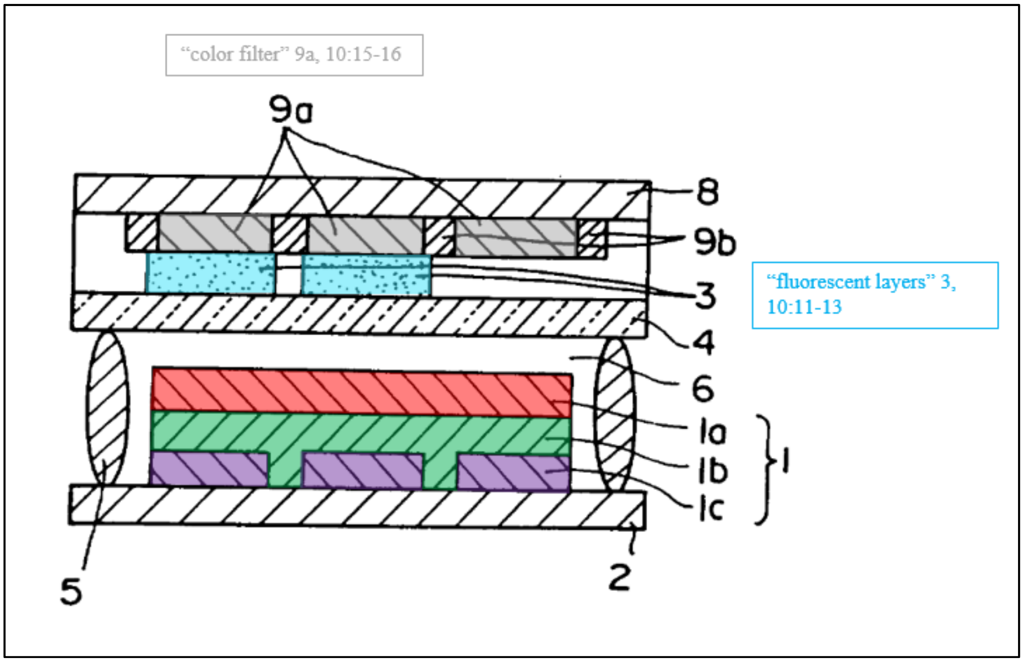
2. Dependent Claim 9

The display apparatus according to claim 1, further comprising at least one wavelength conversion layer formed over said at least one second electrode, said at least one wavelength conversion layer emitting light in a first wavelength range by absorbing light in a second wavelength range emitted from said organic electroluminescent layer.

Eida discloses the limitations of dependent claim 9. That is, Eida discloses a wavelength conversion layer (fluorescent layer 3), formed over a second electrode (transparent electrode 1a), said at least one wavelength conversion layer emitting light in a first wavelength range by absorbing light in a second wavelength range emitted from said organic electroluminescent layer.

As shown in annotated Figure 5 below, Eida's "first invention" includes a fluorescent layer 3, which will "convert the light emitted from an organic EL element into light of a wave length longer than that of the light emitted from the organic EL

element." Ex. 1005, 9:24–26; Ex. 1007, ¶ 201. The fluorescent layers absorb light from the organic compound layer and "emit rays of fluorescent light of different colors . . . to obtain emitted light of the three primary colors (RGB)." Ex. 1005, 10:11–13.



Thus, claim 9 would have been obvious based on the combination of Utsugi's display structure with Eida's wavelength conversion layers.

3. Dependent Claim 11

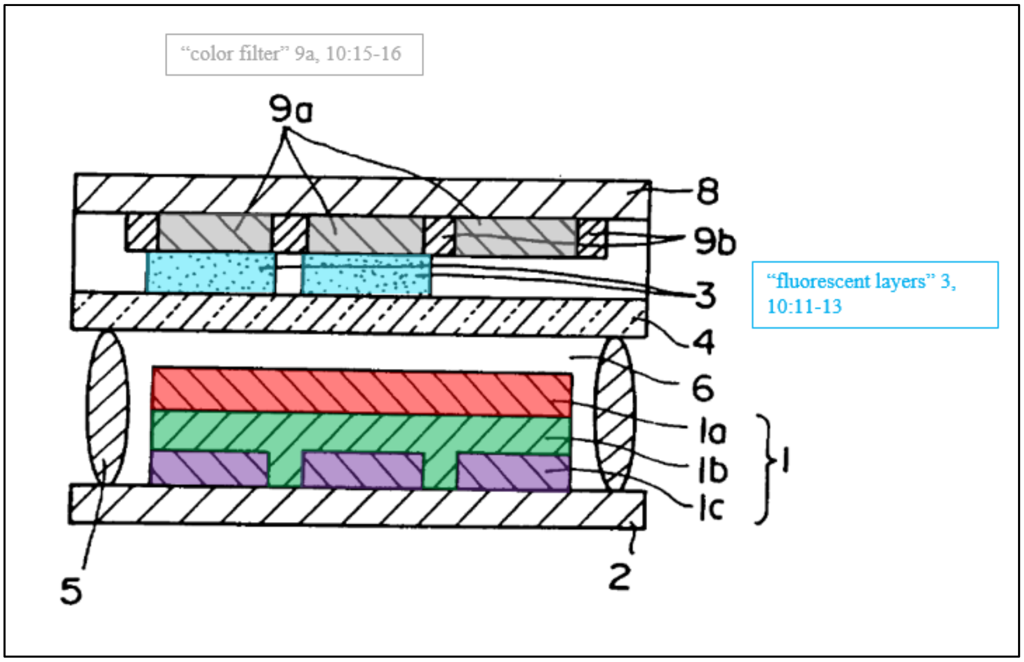
The display apparatus according to claim 9, wherein said at least one wavelength conversion layer has at least two of a red conversion layer which emits light in a red wavelength range, a green conversion layer which emits light in a green wavelength range, and a blue conversion layer which emits blue light.

Eida teaches or suggests the limitations of dependent claim 11. That is, based on the disclosures of Eida, it would have been at least obvious to implement a

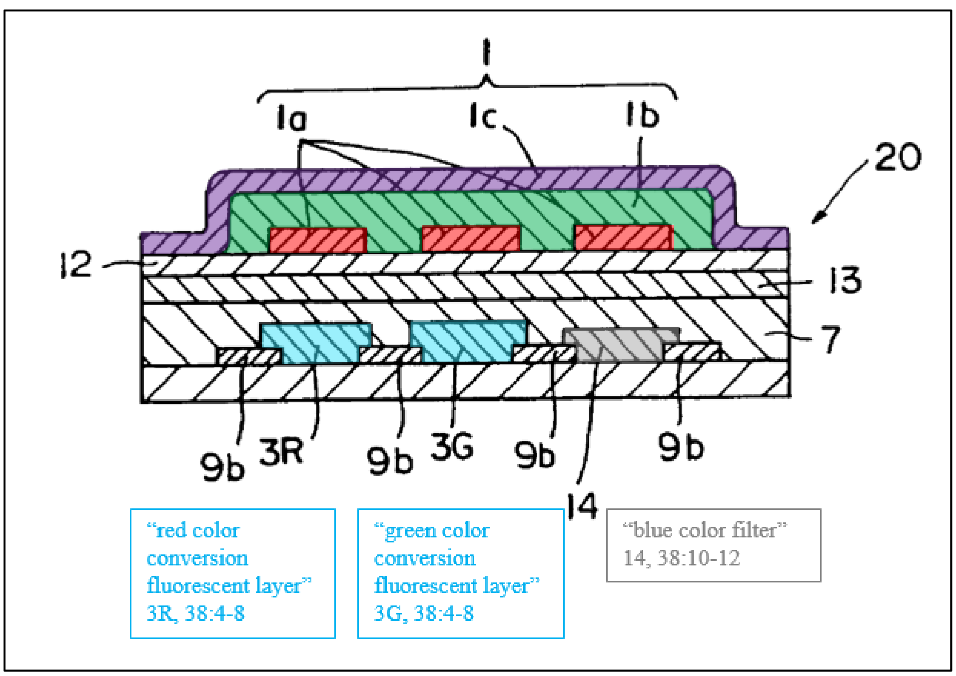
wavelength conversion layer that includes a red conversion layer and a green conversion layer, and thus satisfies the claim language.

Eida discloses that the organic compound layer can emit different wavelengths of light from near ultraviolet light to light of a green color, but that a "blue-green color" is most preferable. Ex. 1005, 10:26–28. It would have been obvious to a POSA to select an organic compound layer that emits blue light, given Eida's teaching, and given the fact that blue light emitting layers have commonly been used in displays since well before the alleged invention of the '450 patent. Ex. 1007, ¶ 207.

Eida discloses that, in its "first invention," "the fluorescent layers 3 which emit rays of fluorescent light of different colors are separately arranged on the same plane to obtain emitted light of the three primary colors (RGB)." Ex. 1005, 10:11–13. As shown in annotated Figure 5 below, Eida discloses the use of two separate conversion layers, i.e., fluorescent layers 3. It would have been obvious to a POSA that, in order to achieve an RGB output using a blue light-emitting organic compound layer, a red conversion layer and a green conversion layer would be necessary, to convert the blue light from the organic compound layer into red and green light, respectively. Ex. 1007, ¶ 206. The red and green light from these conversion layers, along with the blue light from the organic compound layer, would allow for all three primary colors to be emitted from the device. Ex. 1007, ¶ 206.



In fact, Eida's second invention shown in annotated Figure 13 below provides an even more explicit depiction of this type of structure, where the red conversion layer has been labeled "3R" and the green conversion layer has been labeled "3G." Ex. 1007, ¶ 208.



A POSA would have understood that the description of the color conversion layers in Eida's second invention applies equally to Eida's first invention. Ex. 1007, ¶ 208. Indeed, Eida teaches that the "[m]aterials used for the fluorescent layer [in the second invention] can be the same materials as those used in the first invention." Ex. 1005, 40:25–26.

Regarding the conversion layers, Eida discloses materials that can be used for converting the blue emission of the organic EL device to green light, including:

> coumarin type coloring material such as 2,3,5,6-1H, 4H-tetrahydro-8-trifluoromethylquinolizino(9,9a,1-gh)coumarin (hereinafter abbreviated as (coumarin 153)), 3-(2'-benzothiazolyl)-7-diethylaminocoumarin (hereinafter abbreviated as (coumarin 6)), and 3-(2'-benzimidazolyl)-7-N,N'-diethylaminocoumarin (hereinafter abbreviated as (coumarin 7)), other coumarin coloring material type dyes such as basic yellow 51, and naphthalimide type coloring materials such as solvent yellow 11 and solvent yellow 116.

Ex. 1005, 30:17–24; Ex. 1007, ¶ 207.

Eida further discloses a number of different materials for converting the blue emission of the organic EL device to red light, including:

> cyanine type coloring materials such as 4-dicyanomethylene-2-methyl-6-(p-dimethylaminostyryl)-4-H-pyran (hereinafter abbreviated as (DCM)), pyridine type coloring materials such as 1-ethyl-2-(4-(p-dimethylaminophenyl)-1,3-butadienyl)-pyridinium-perchlorate (hereinafter abbreviated as (pyridine 1)), rhodamine type coloring

> materials such as rhodamine B and rhodamine 6G, and oxazine type coloring materials.

Ex. 1005, 30:26–32; Ex. 1007, ¶ 207.

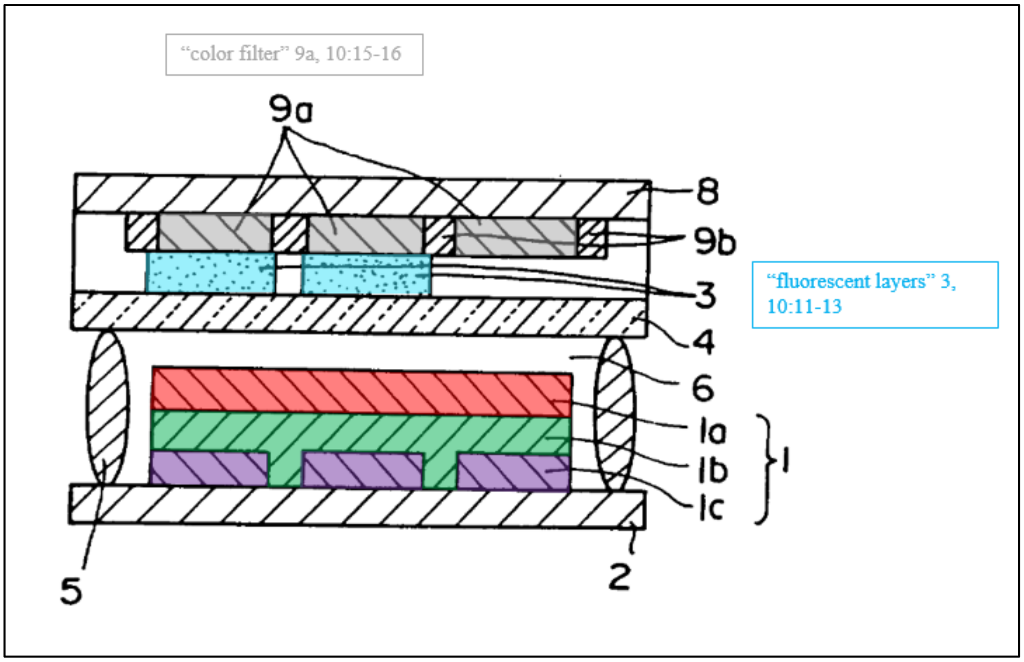
Thus, claim 11 would have been obvious based on the combination of Utsugi's display structure with Eida's wavelength conversion layers.

4. Dependent Claim 12

> **The display apparatus according to claim 1, wherein: said display apparatus further comprises at least one filter formed above said at least one second electrode; and light [r]ays in a first wavelength range pass through said at least one filter selectively when incident light rays in a second wavelength range including said first wavelength range enter said at least one filter.**

Eida teaches or suggests the limitations of dependent claim 12. That is, Eida discloses at least one filter (color filters 9a) formed above said at least one second electrode (transparent electrode 1a), and a POSA would understand Eida's color filters as selectively allowing the passage of light rays in a particular wavelength range.

In connection with Eida's first invention, Eida discloses that, "as shown in [annotated] FIG. 5, a color filter 9a may be arranged on each of the fluorescent layers 3 to control the fluorescent colors and thereby to promote the color purity." Ex. 1005, 10:15–16; Ex. 1007, ¶ 211.



A POSA would understand that, consistent with the conventional operation of a color filter, the filters of Eida's first invention selectively allow only a portion of the spectrum of light incident on the filter to pass through. Ex. 1007, ¶ 211. Accordingly, a POSA would understand Eida as teaching or suggesting that "[r]ays in a first wavelength range pass through said at least one filter selectively when incident light rays in a second wavelength range including said first wavelength range enter said at least one filter." Ex. 1007, ¶ 211.

Thus, claim 12 would have been obvious based on the combination of Utsugi's display structure Eida's color filters.

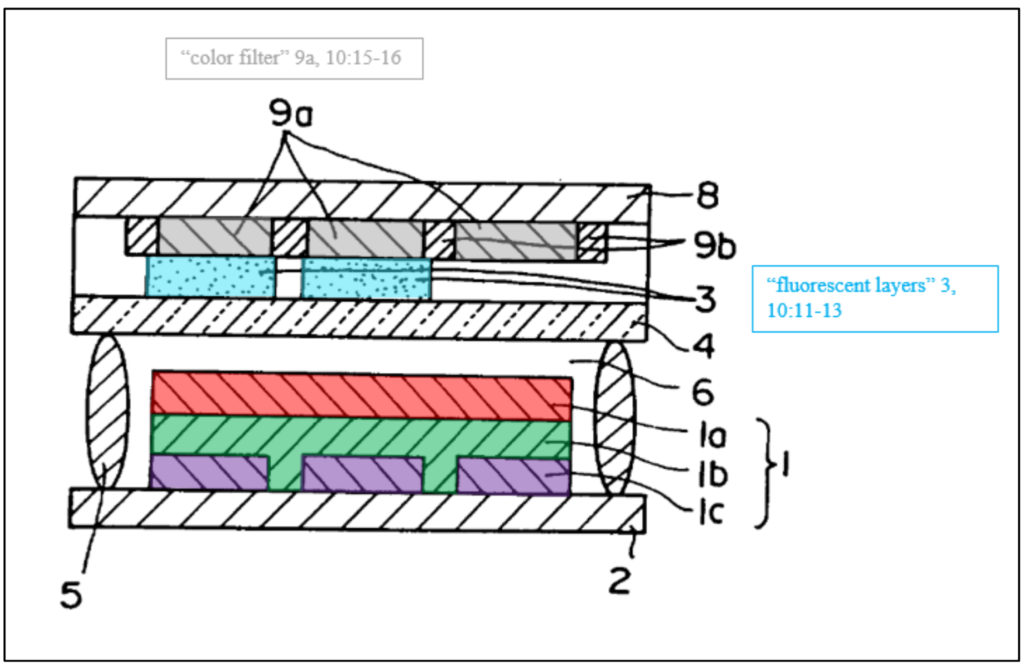
5. Dependent Claim 13

The display apparatus according to claim 12, wherein said at least one filter has a red filter which makes light in a red wavelength range pass through, a green filter which makes light in a green wavelength range pass through, and a blue

filter which makes light in a blue wavelength range pass through.

Eida teaches or suggests the use of a red filter which makes light in a red wavelength range pass through, a green filter which makes light in a green wavelength range pass through, and a blue filter which makes light in a blue wavelength range pass through.

As depicted in annotated Figure 5 below, Eida teaches the use of three separate color filters 9a. As Eida explains, "a color filter 9a may be arranged on each of the fluorescent layers 3 to control the fluorescent colors and thereby to promote the color purity." Ex. 1005, 10:15–16; Ex. 1007, ¶ 214.



As previously discussed, the fluorescent layers 3 "emit rays of fluorescent light of different colors . . . to obtain emitted light of the three primary colors (RGB)" Ex. 1005, 10:11–13. It would have been obvious to a POSA that, to achieve an RGB

output using a blue light-emitting organic compound layer, it would be necessary to use a red conversion layer and a green conversion layer, to convert the blue light from the organic compound layer into red and green light, respectively. Ex. 1007, ¶ 215.

It would have been equally obvious to POSA that to promote the color purity of each primary color, as taught by Eida, red and green filters would be arranged on top of their respective color conversion layers, and that a blue filter would be used to filter the blue light coming directly from the organic compound layer. Ex. 1007, ¶ 216. In fact, Eida explicitly notes with respect to its second invention that "[a] blue color filter 14 may be disposed in parallel with the red color conversion fluorescent layer 3R and the green color conversion fluorescent layer 3G, thereby adjusting the colors of light emitted from the organic EL element to improve the purity of these colors." Ex. 1005, 38:10–12. The same concept would apply equally to the first invention of Eida. Ex. 1007, ¶ 216.

Thus, based on the teachings of Eida, it would have been at least obvious to use red, green, and blue color filters—which respectively make light in red, green, and blue wavelengths pass through. Accordingly, claim 13 would have been obvious based on the combination of Utsugi's display structure with Eida's color filters.

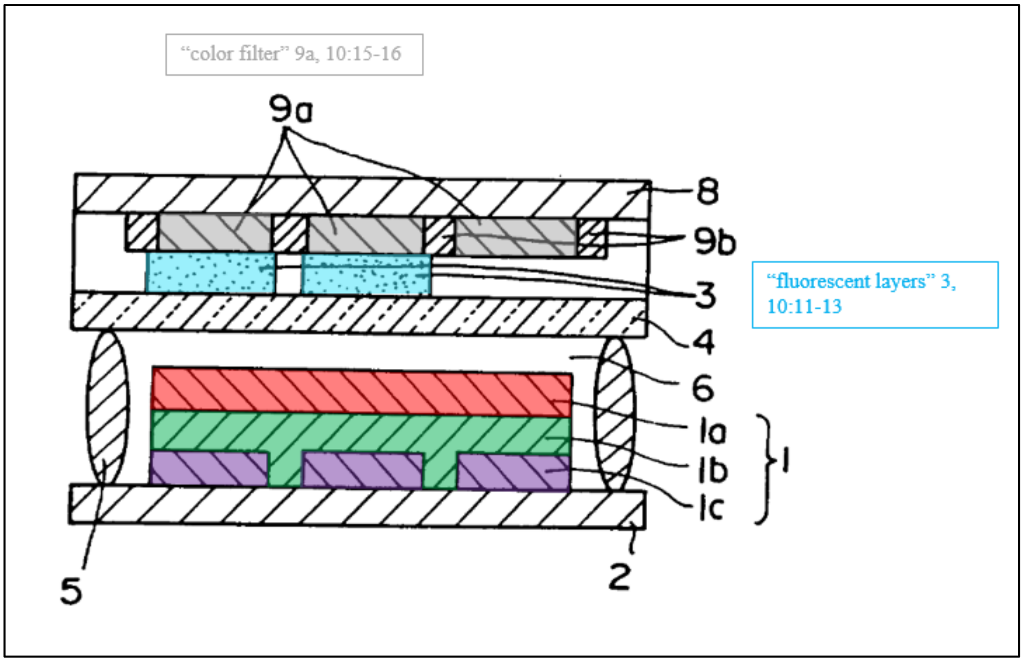
6. Dependent Claim 17

The display apparatus according to claim 1, wherein said display apparatus further comprises at least one filter,

formed above said at least one second electrode, which selectively permits light rays in a first wavelength range to pass therethrough when incident light rays in a second wavelength range including said first wavelength range enter said at least one filter.

Eida teaches or suggests the limitations of dependent claim 17, for reasons very similar to those provided for dependent claim 12. That is, Eida discloses at least one filter (color filters 9a) formed above said at least one second electrode (transparent electrode 1a), and a POSA would understand Eida's color filters as selectively permitting the passage of light rays in a particular wavelength range. Ex. 1007, ¶ 219.

In connection with Eida's first invention, it discloses that, "as shown in [annotated] FIG. 5, a color filter 9a may be arranged on each of the fluorescent layers 3 to control the fluorescent colors and thereby to promote the color purity." Ex. 1005, 10:15–16.



A POSA would understand that, consistent with the conventional operation of a color filter, the filters of Eida's first invention selectively allow only a portion of the spectrum of light incident on the filter to pass therethrough. Ex. 1007, ¶ 219. Accordingly, a POSA would understand Eida as teaching or suggesting that "rays in a first wavelength range . . . pass therethrough when incident light rays in a second wavelength range including said first wavelength range enter said at least one filter."

Thus, claim 17 would have been obvious based on the combination of Utsugi's display structure with Eida's color filters.

7. Dependent Claim 18

The display apparatus according to claim 17, wherein said at least one filter has a red filter which permits light in a red wavelength range to pass therethrough, a green filter which permits light in a green wavelength range to pass

therethrough, and a blue filter which permits light in a blue wavelength range to pass therethrough.

Eida teaches or suggests the limitations of dependent claim 18, for the same reasons discussed above for dependent claim 13.

That is, based on the teachings of Eida, it would have been at least obvious to use red, green, and blue color filters, as discussed for claim 13. Ex. 1007, ¶¶ 221–225. And such filters respectively permit light in red, green, and blue wavelengths to pass therethrough. Ex. 1007, ¶¶ 221–225. Accordingly, claim 18 would have been obvious based on the combination of Utsugi's display structure with Eida's color filters.

IX. CONCLUSION

Petitioner respectfully requests *inter partes* review and cancellation of claims 1–9, 11–13, and 15–18 of the '450 patent.

Date: November 7, 2019

Respectfully submitted,

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CERTIFICATION UNDER 37 C.F.R. § 42.24(D)

I certify that the foregoing complies with the type-volume limitation of 37 C.F.R. § 42.24 and contains 13,891 words based on the word count indicated by the word-processing system used to prepare the paper, and excluding those portions exempted by § 42.24(a).

Date: November 7, 2019

David A. Garr, Esq.
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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6 and 42.105, I certify that the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 6,072,450 Under 35 U.S.C. §§ 311–319 and 37 C.F.R. § 42.100 *et seq.*, together with Petitioner's Exhibits Nos. 1001–1024, was served by FedEx, a means at least as fast and reliable as Priority Mail Express®, on the following correspondence address of record for patent owner:

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